An Outline of Modern Knowledge

Ed. by. Dr. William Rose

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EDITED BY DR. WILLIAM ROSE

AN OUTLINE OF MODERN KNOWLEDGE

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ON

SCIENCE · PHYSICS · ASTRONOMY ·
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INTRODUCTION

The progress of scientific study and experiment during the present century, and more particularly since the War, has done more than add to the sum of facts. The whole outlook has changed and is changing. The materialistic and mechanistic views of last century, encouraged and strengthened by the biological discoveries of Darwin, are giving place to speculations which are in danger of falling into the abyss of mysticism. Yet, as Professor Wolf points out, matter remains matter, however our conceptions of its nature may change, and it is still too early to state the precise implications of the new discoveries and theories. Man, in his present condition, represents a stage in an evolutionary process which is still going on, and all the efforts of scientists are ultimately directed towards the one end—to reveal the nature of man's existence and the universe of whose creative forces he is, so far as we know, the crowning achievement.

The sciences can no longer work independently. They are all branches of one great investigation, and the discoveries of one react upon the other. All are liable to be influenced by any change of outlook which may come about through the advances of any one of them, and the progress of one science may be conditioned by new methods and discoveries in another. A channel of inquiry may even be blocked before the goal is reached, and the physicist, for example, who can tell us about the structure and behaviour of things, may, if mind should prove to be the ultimate reality, have eventually to leave to the psychologist the task of explaining what matter *is*. Fields of study are becoming ever smaller, but are, at the same time, undergoing a process of liberation. Science has become divorced from philosophy; philosophy is no longer expected to subserve the interests of theology ; psychology is standing on its own feet ; psycho-analysis, the offspring of psychology and medicine, though one of the youngest of the sciences, is yet including every aspect of man's activity in its domain—and the process of differentiation is being continued even in psycho-analysis, which has split up into three schools, one of which denies the title to the other two. Scientific investigation is thus becoming more departmentalised ; each worker finds himself compelled to devote his mind and energies to a more restricted field, and the prospects of a final synthesis are growing more remote. It is true that attempts are being made every day to present to the lay public an exposition of one science or of all sciences, with a view to presenting the conclusions of theory and investigation in a form which will be easily intelligible to the inquirer who wishes to overleap the laborious stages by which generations of scholars have contributed to present results. But it is not possible to popularise to more than a certain extent without putting matters so simply that the explanation ceases to be true.

The planning of the present book was therefore based on the assumption that the only way to provide a conspectus of the actual achievements of scholarship and thought would be in a sufficient number of presentations by leading authorities who are themselves original investigators in the essential fields of study. Each contributor outlines the past history of his subject before leading up to an exposition of the present state of knowledge and the relation of his field of work to the life and thought of to-day. Each Article has been specially written for this book, and there has been sufficient discussion between the editor and the contributors, and between the contributors themselves, to ensure that it shall fit into its place in the general plan. An essential condition of the success of the book's intention was that simplification should not be carried to the stage which must inevitably result in distortion, yet that the thought in each contribution should be developed with a gradualness and lucidity which would make every successive point crystal clear to the reader who comes fresh to the subject. Each reader will be able to make his own synthesis, in so far as any kind of synthesis is possible, and will be helped towards an understanding of the fundamental problem which mankind has still to solve—the problem of life itself, with the questions it entails of free-will and survival.

All study is intimately bound up with the fate of man, and these Articles all have a bearing on his provenance and destiny, on both the realised and unconscious purport of his activities and the significance of the physical and spiritual forces, the external and the internal influences, which are affecting him for good or for ill. They show how science, philosophy, psychology, historiography and economics, together with the study of art in its various forms, are delving into the nature of existence, considering it not only in the light of what has gone before, but in view of the goal to which man and the universe may be tending. In the words of Dr. Marett : " To consider ourselves in the light of what we may reasonably hope to become is our first and last duty as self-directing beings." If we ask what is the value of the study of the past, Professor Hearnshaw points out that its aim is the explanation and elucidation of the present, that the purpose of the historian is to attain to an understanding both of his environment and of himself. If we ask what science is doing, and what we may expect it to do, towards giving man power over his future development, Professor Crew contemplates the eventual control of biological functions for furthering the happiness and progress of mankind, and Professor Flügel holds out the promise that psycho-analysis may enable us to become more conscious of ourselves, and thus extend our powers of rational insight and control. We may therefore look forward to the time when man will be master in his world, when he will be able to regulate some, at any rate, of the physical and mental forces of which he is at present largely the plaything. Mr. Fry, on the other hand, points to an activity which appears to be " biologically useless," a purely spiritual activity analogous to that which impels men to search for truth, and suggests that this is responsible for our most cherished works of art. It is also, in fact, responsible for some of the finest scientific achievements of the human mind, and the æsthetic element in their work is recognised by some scientists. Neither can it be denied, to take the other side of the picture, that there is a scientific aspect to the search for beauty.

The scientist cannot define matter nor state the precise nature of sex, not because he knows little about them, but because he knows so much. Yet religious leaders, politicians, and economists have based their doctrines on scientific theories which have now to be cast into the limbo of outworn beliefs, and, though the theories be discarded, the doctrines are often slow to follow. Even art cannot divorce itself from the changes that take place in the realms of science and philosophy. The Naturalist movement towards the end of last century, which was the literary culmination of the growing sense of reality among imaginative writers, was closely bound up with the trend of thought that was due to the theory of organic evolution, and much of the most significant literature of the post-War years would have been unthinkable without the revolution in the outlook of physical science and the discoveries of the new psychology of the unconscious. The Naturalists thought they could photograph reality. We are now asking, " What *is* reality ? "

The composite view of the universe is no longer systematic, or even intelligible, but at the same time as it is being widened and deepened it is growing more confused. In so far as it is possible to construct a clear picture, which must necessarily be in the nature of a mosaic, of the present achievements of human thought and knowledge, and to summarise the evidence which may point to a directive or purposive agency in the universe, this book attempts to do so.

WILLIAM ROSE.

THE UNIVERSITY OF LONDON
KING'S COLLEGE, *June*, 1931

AN OUTLINE OF MODERN KNOWLEDGE

A PHILOSOPHIC AND SCIENTIFIC RETROSPECT

By

A. WOLF

SYNOPSIS

Ancient Times.	Man's emergence from the mythological stage — The beginnings of philosophic and scientific thought among the Greek colonists in Asia Minor — The early nature philosophers before the age of Socrates — The golden age of Greek thought in Athens : Socrates, Plato, and Aristotle — Their successors — Philosophy and science in Alexandria, the greatest meeting place of East and West — The end of Antiquity — The closing of the Schools in A.D. 529.
The Middle Ages.	Philosophy in Islam and among the Jews in Moslem countries — The Fathers of the Church and the Scholastic philosophers — Science in the Middle Ages — The Renaissance, the Reformation, the Copernican revolution, and the transition to the modern period.
Modern Times.	Gradual emancipation from bondage to authority — Science in the seventeenth century — Philosophy in the seventeenth century — Philosophy in the eighteenth century — Science in the eighteenth century — Philosophy in the nineteenth century — Science in the nineteenth century — The predominance of idealism in philosophy, and of materialism in science during the middle decades of the nineteenth century.

A PHILOSOPHIC AND SCIENTIFIC RETROSPECT

The belief in evolution is sufficiently wide-spread and deep-rooted by now to incline intelligent people to suppose that no period of human thought, not even the latest scientific and philosophic theories, can be regarded as isolated and self-contained. In one way or another, usually in many ways, each intellectual era has its preparatory historical antecedents, a knowledge of which makes it more intelligible than it would be otherwise, helps people to exercise moderation in their expectations from the latest ideas, and to spare themselves the shock which is apt to come to those who fail to appreciate the inevitableness of incessant change in man's intellectual orientation. Thoughtful people have long since realized that the *latest* word in science or philosophy is by no means the *last* word, and that probably there is no last word in these great enterprises of the human spirit. This is no ground for discouragement. The spirit of an age, as of an individual, must be judged, not by the finality of its achievement, but by the seriousness of its endeavours in the light of its own day; and the very absence of finality leaves ample scope for succeeding generations to carry on the ceaseless quest. And the quest is not altogether in vain. Absolute aberration appears to be a rare phenomenon in the history of human thought. For the most part the intellectual achievements of past ages not only serve a useful temporary purpose but also embody something of more enduring value. Indeed, to the student of the history of human thought one of the most surprising things is the persistence throughout the ages of the same stock of fundamental ideas, which are often modified and refined in many ways but are never abandoned entirely. Be that as it may, the human quest for truth is certainly one of the greatest enterprises of man, if not the greatest of them; and the story of that quest has an intrinsic interest of its own, besides affording some help to the understanding of the present and of its roots in the past.

ANCIENT TIMES

Of the period of two hundred and fifty thousand years or more that the human race has already been in existence, only a very small fraction comes within the purview of the historian of human thought. The great bulk of that long period was consumed in the struggle for bare existence amid the destructive forces of nature. Man had to act long before he could think. He had to react to his physical environment long before he had the capacity or the leisure to try to understand it. The life-and-death struggle prompted by the will to live, and later by the will to power, was no doubt haunted from an early period by a certain vague sense of wonder and bewilderment. And to this day something of that sense of wonder and bewilderment may haunt the performance of religious rites, which are the offspring of those magic performances by which early man endeavoured to control and to compel, or to coax and appease, the deified forces of nature on which he felt himself so dependent. In course of time mythologies and other more intellectual explanations were attached to the primitive ritual. The explanations change from time to time according to the intellectual level of the age, but the emotional element associated with the religious ritual may continue more or less the same, reminiscent perhaps of that vague sense of wonder and bewilderment which haunted primitive man already at the pre-intellectual stage of human existence.

Some vague notion of cosmic orderliness may be discerned already at the mythological stage of human thought. Early Greek mythology, for instance, introduces the figure of Nemesis, the goddess who checks and controls the wild things in nature and so maintains some measure of order in nature. It is true, of course, that in the mythology of the Greeks a considerable rôle is played by Pan, the goat-footed and goat-minded lord of lawlessness. This is natural enough, for the wildness and rough play of natural forces seem to lie on the surface of things, and so impress one first of all. It is therefore all the more significant that some idea of order, in physical nature and in human life, should have emerged so early. The conception of order among the phenomena of nature appears to have grown *pari passu* with the growth of order in human societies. The use of the term " law " to express the regularity of natural phenomena is clearly reminiscent of the " law and order " decreed and enforced by a sovereign power in a society ; and to this day some people cannot divorce the notion of " law " from that of a legislator.

The transition from a mythological view of natural events to a more scientific and philosophical attitude was a very slow one, and even when it was accomplished the separation was not quite complete. For the more scientific attitude was the result of an increasing rationalization of mythological ideas, which may often be traced easily in their more intellectual transformations. Thus, for instance, the water in which Thales found the origin of all things is reminiscent of Osiris ; the fire to which Heraclitus traced everything recalls the sun-god Ra ; and Nemesis reappears in the " avenging spirits " which, according to the same Heraclitus, keep the sun within his orbit. In this kind of way it would be possible, if one had the time and the patience, to decipher the palimpsest of human thought throughout the ages. But that is unnecessary for the present purpose. It is enough to point out that when scientific and philosophic thought, as distinguished from mythological thought, made its first appearance, on the Western coast of Asia Minor, it was indebted to no small extent to the preceding mythological thought throughout the then civilized world, as well as to the many practical achievements of Egypt and Mesopotamia, and probably of other countries also. Western thought, however, during the past twenty-five centuries or so, is sufficiently comprehensive and self-contained to justify our confining our attention to it.

Pre-Socratic Thinkers

One of the persistent questions in the history of human thought refers to the nature of the ultimate stuff, or substance, of which all things are composed and to which they eventually revert. For some reason or other the human mind always inclined to assume that the vast diversity of objects which make up the visible world is at bottom made up of the same stuff, and tried to determine what that ultimate stuff is. This question was first raised and answered in a non-mythological manner by a group of Greek thinkers who lived in Ionia, on the west coast of Asia Minor. The answer was crude. Thales (*c.* 640–550 B.C.) suggested that water was the primary stuff. Anaximenes (*c.* 590–525 B.C.) suggested air ; and Anaximander (*c.* 610–545 B.C.) made the more deep-sighted suggestion that the primary stuff must be something different from the various determinate forms of matter known to us, and so described it simply as the " boundless " or " indeterminate," out of which such determinate substances as fire, air, water and earth " separated out " or were differentiated. The merely mythological stage was thus passed. They no longer asked *who* created the world of things, but *what* was the stuff of which they were made ; and in place of the mythological processes based on the analogy of child-birth, Anaximenes suggested the processes of condensation and rarefaction as the processes by which the primary matter became transformed into the great variety of familiar things. These early thinkers traced the origin of all things to a material basis and to material processes, yet it would not be right to describe them as materialists, because the hard and fast distinction between mind and matter was alien to their ways of thinking. For them, and for the Greeks generally, matter was something living. They were *hylozoists*, not materialists : they regarded all things as composed, not of dead inert matter, but of living substance.

A more subtle conception of the nature of the ultimate principle (or primary stuff) of things was introduced by Pythagoras (*c.* 570–500 B.C.) and his school. They laid stress on the *form*, rather than on the matter, of things as constituting their permanent reality. The study of music led them to the discovery of the importance of *proportion* (say, between the lengths of strings and the notes which could be produced on them). This idea was applied by them in every possible direction. The health of a body, for example, was regarded as resulting from a certain proportion between its elementary qualities (hot and cold, dry and wet) ; other proportions between them would lead to various diseases. Extending this conception, they maintained that the principle or essence of all things is to be found in their several *forms*. They expressed this view in the dictum that " all things are numbers." Numbers and forms were easily identified in those days, because numbers were frequently represented by dots arranged in certain geometrical forms or patterns (as they still are on dominoes and cards). This custom rather encouraged the Pythagorean view, or at least made it seem plausible. For the unit of number was easily identified with the dot or point. Now, lines can be analysed into points, planes into lines, and solids into planes. This made it appear that points make lines, which make planes, which make solids. So the identification of the point with the unit of number readily made it appear that " all things are numbers " or made up of numbers. In one way or another the belief in the supreme importance of mathematics in science has maintained itself ever since the days of the Pythagoreans.

The Pythagorean School had been founded in Southern Italy by a refugee from Ionia, after the Persians had conquered it. The Persian conquest of Ionia filled the suffering Greeks with a kind of religious revival. The Pythagorean School was a kind of religious brotherhood with a philosophical bias. But the secular spirit was maintained and sharpened by other Greek thinkers in Elea, in Southern Italy. Noteworthy among these is Xenophanes (*c.* 570–480 B.C.), who made a scathing attack on the current conception of the gods. " Mortals [he said] believe that the gods come into being as they themselves do, that they have senses, voice, body. . . . But if oxen or lions had hands, oxen would make gods like oxen, horses would make gods like horses." Strongly opposed to the religious anthropomorphism (the tendency to regard God, or the gods, as like men) and polytheism of his time, he believed in " one supreme God . . . like unto mortals neither in body nor in thought." According to the reports of Aristotle, Xenophanes was the first Western monist and pantheist. He is usually regarded as the author of the statement : " The All is One, and the One is God." (The first part of this statement expresses his monism ; the second part, his pantheism.) The monistic philosophy of Xenophanes was strongly supported by other Eleatic philosophers, notably by Parmenides (*c.* 540–480 B.C.) and Zeno (*c.* 490–420 B.C.). Parmenides considered it unthinkable that things should come into existence out of nothing, or that they should ever dissolve into nothingness. He maintained, accordingly, that the world is one, uncreated and imperishable reality. Motion and other kinds of change, and the discreteness of ordinary things, he regarded as illusory appearances. Zeno's famous paradoxes were meant to show that a pluralistic conception of the world involved absurdities. Perhaps the most striking feature in the views of the Eleatic thinkers is their stress on *thought* as the only source of real knowledge, the senses being regarded as illusory.

In opposition to the Eleatics, Heraclitus (*c.* 540–475 B.C.) emphasized the multiplicity of things and their incessant change, though he shared the Eleatic view of the eternity of primary matter. His conception of the cosmic process was that of periodic cycles of change, each cycle beginning and ending in a mass of fire. Perhaps the most valuable thing in the teaching of Heraclitus was his stress on the orderliness of natural events—all changes, he insisted, occur " by measure." This regularity, moreover, was regarded as evidence of the existence of " universal reason " either in primary matter or side by side with it. Pluralism was carried a stage further by Anaxagoras (*c.* 500–428 B.C.) and Empedocles (*c.* 483–430 B.C.), and culminated in the atomic theory of Democritus (*c.* 460–370 B.C.). Anaxagoras held that there is not one kind of primary stuff, but a great variety of " seeds " of things through the various combinations of which all sorts of different objects are produced. Empedocles substituted the idea of four " roots " for that of the numerous " seeds " of Anaxagoras. The " four roots " of things were the familiar " four elements "—fire, air, water, earth. To account for the combination and separation of these elements he formulated two principles of attraction and repulsion (or " love " and " hate," as he called them). The atomic tendency of Empedocles betrayed him into some curious biological speculations. He suggested that the several parts of the living body existed separately at first, and then combined in all sorts of ways (like the " roots " of matter). But he has the merit of having suggested also the first notion of " the survival of the fittest." For he held that of all the numerous combinations of the parts of living bodies, only those survived which were fit to live.

The atomic theory appears to have been first formulated by Leucippus (*c.* 500–430 B.C.), but is usually associated with the name of his follower Democritus, who is consequently known as " the father of physics." According to Democritus, the only ultimate realities are atoms and space. The atoms vary in size and shape, and all compound bodies are made up of them. The differences found among compound bodies are due partly to the differences in shape and size of the atoms of which they are composed, partly to the position of the atoms, and partly to their arrangement in the composite bodies. The atoms, in short, were regarded as the alphabet of the universe, and the differences just referred to may be illustrated by means of letters of the alphabet. Thus, for instance, A and M differ in shape and size ; M and W differ in position (invert either and you get the other) ; ON and NO differ in arrangement. The last of these differences recalls the " form " of the Pythagoreans. The atoms, according to Democritus, are not inert, but endowed with motion. This view of the atoms avoided the difficulty (which perplexed subsequent thinkers until the age of Newton) as to how inert matter was first set in motion. The atoms moving about spontaneously in all directions get entangled with one another and so form composite bodies of all kinds, including whole worlds. Under suitable conditions also such composite bodies collide with one another, and some of them break up again into separate atoms. The atomic theory thus attempted a purely " mechanical " explanation of the universe, that is, an explanation solely in terms of matter and motion. This involved the denial of the objective reality of the so-called " secondary " qualities (colours and sounds, smells and tastes, etc.), which could not be explained mechanically. " According to *convention* [Democritus is reported to have said], there is a sweet and a bitter, a hot and a cold, and according to convention there is colour. In *truth* there are atoms and a void." The contrast between the *conventionally* right and what is *truly* (or objectively) right had been made current by the Sophists. And the Atomists adopted the distinction for their own purposes. To describe the secondary qualities as " conventional " was tantamount to a denial of their objective reality and to reducing them to the subjective status of illusions. The atomic theory continued to enjoy considerable popularity throughout the subsequent history of human thought, though it has undergone many and important changes with the development of experimental physics and chemistry.

The Persian conquest of Ionia, we have seen, led to the dispersal of the Ionian philosophers, and so to the spread of philosophic interest elsewhere. Of far greater importance was the subsequent triumph of the Greeks over the Persians. This great upheaval produced a spirit of dissatisfaction with existing conditions and current beliefs, and awakened a wide-spread interest in knowledge. A class of professional teachers responded to the demand. These were the " Sophists " or " wise men." They did much for the spread of general education, and by their criticism of current beliefs compelled other thinkers to probe deeply into the great problems of human life. It was they who gave currency to the distinction between mere convention and intrinsic value, and directed special attention to problems of specifically human interest. The most familiar doctrine associated with the Sophists is that contained in the dictum of Protagoras : " Man is the measure of things." This dictum is frequently regarded as an anticipation of the very much later pragmatism (or humanism) in its stress on the relativity of truth and goodness to the practical needs of man. It was in the period of the Sophists that Athens first became the centre of Greek philosophy, which attained its golden age in the genius of Socrates, Plato and Aristotle.

The Golden Age of Greece

Socrates (469–399) shared some of the views and interests of the Sophists, and his contemporaries mostly regarded him as one of them. For, like the Sophists, he also tried to promote general education, was particularly interested in questions of human conduct, and found much to criticize in current beliefs. But he believed in the possibility of real knowledge (as distinguished from varying personal opinions), if it were sought in the right manner. The method he proposed and pursued was in essence the inductive method. It consisted in checking tentative suggestions by reference to relevant instances until ideas could be formulated in harmony with all the relevant facts. Knowledge appeared to him so important that he identified even virtue with knowledge, namely, a knowledge of what is right. As Socrates left nothing in writing, his general philosophy of life could only be gathered from his own conduct, and this could be variously interpreted by stressing one or other of its several aspects. Aristippus and the Cyrenaics emphasized the cheerfulness of Socrates and his capacity for reasonable enjoyment, and so claimed his weight on the side of hedonism, the view that pleasure is the end and standard of conduct ; Antisthenes and the Cynics stressed Socrates' indifference to hardships and his readiness to dispense with comfort when necessary, and so they claimed him as an advocate of the simple life. However, the greatest influence exercised by Socrates on subsequent thought had reference to his method of acquiring knowledge. His emphasis on the supreme importance of developing true *concepts* or ideas was taken up partly by Euclid and the Megarians, but above all by Plato.

Plato (427–360 B.C.) attempted to harmonize the views of Heraclitus, Pythagoras and Socrates. He agreed with Socrates that knowledge is possible, and that it is possible only by means of concepts or general ideas or truths. But he also agreed with Heraclitus that the objects of ordinary observation are an " ever-rolling stream " of changing events, of which no universal truths can be asserted. He therefore concluded that the real objects of knowledge are not the ever-changing things of the world of sense-perception but certain supra-sensible, immutable objects which he named " Ideas," and which he conceived more or less in the manner of the Pythagorean " Forms." The world of sense has but a lower sort of reality and consists of mere " imitations " of, or crude approximations to, the " Ideas." So he distinguished two types of objects and two kinds of cognition. Real knowledge is concerned with the " Ideas," or with the world of eternal Being ; sense-perception is a lower kind of cognition, which he called " opinion," and is concerned with the world of change, or of mere " becoming." Possibly Plato's " Ideas " may have been intended to represent the eternal Laws of Nature. If so, the description of ordinary sense-objects as " imitations " of the " Ideas " was probably intended to bring out the fact that the conformity of ordinary objects and events to natural laws is never precise, only approximate. In any case Plato's conception of the universe was that of an interconnected system, working not merely mechanically but teleologically, that is tending towards cosmic end or purpose—" the Good " towards which the whole creation moves. Allegorically Plato compares " the Good " with the sun. The sun is at once the source of the growth of things and also of the light by which they are seen, so " the Good " is at once the source of all reality and of our knowledge of it. As fountains of personal inspiration no thinkers have surpassed Socrates and Plato, and only very, very few have equalled them. But with regard to calm scientific attitude of mind and scientific and philosophic achievements, the most important thinker of ancient times was probably Aristotle.

Aristotle (384–322 B.C.) was the first to introduce into human knowledge much of that system and articulation which it still retains more or less. His writings are encyclopædic and gather together all the important contributions to human thought up to his time, while his own contributions were colossal. Generally speaking Aristotle was more empirical and realistic than Plato, that is to say, he had more respect for the world of sense, but he was not blind to other aspects of reality, and actually shared some of Plato's fundamental views. Aristotle agreed with Socrates and Plato about the importance of general ideas or concepts for knowledge. But he declined to accept a world of Platonic " Ideas " more or less aloof from the world of sense. He regarded ideas as necessary in order to explain or to understand the world of experience, and he endeavoured to reconcile ideas with percepts, universals with particulars, as jointly constituting the world of reality and of knowledge. His attempt was based on the notions of *matter* and *form*, which had hitherto been divorced from each other, but which he joined in a new harmony. Whereas the early Ionians had stressed *matter* only, while the Pythagoreans and Plato stressed *form* only, Aristotle maintained that they belong to one another, that *form* is immanent in *matter*, the universal is immanent in the particular—they may be distinguished, but not separated from one another. Plato's " Idealism " was largely the outcome of his pre-occupation with pure geometry and its ideal figures. Aristotle's interests were mainly biological, and his study of the phenomena of growth and development gave no encouragement to the conception of immutable " Ideas." In fact by his use of the conceptions " form " and " matter " Aristotle attempted to reconcile the opposite views of those who, like the Eleatics, treated change as illusion and identified the real with the immutable, and those who, like Heraclitus and his followers, identified the real with the " flux " of change or process. Aristotle tried to do justice to both. He recognised in all ordinary things both matter and form, or a comparatively raw stuff and some finishing touch which made it a comparatively finished product. The nature of the distinction varies in different cases. In the case of a statue the marble is the matter, the shape imposed on it by the sculptor is its form. In the case of a plant, or an animal, or a man, the bodily structure is the matter, while a certain function or combination of functions (nutrition, sensibility or reason, respectively) constitutes the form. In the case of human character certain impulses and instincts constitute the matter, while the way in which they are organised, drilled or " licked into shape," constitutes the form. Moreover, nothing is without some form. Even the most elementary kinds of matter recognized in his time (fire, air, water, earth) were regarded by Aristotle as different forms of primary matter resulting from different combinations of ultimate qualities (dry, moist, hot, cold). Primarily, formless matter was only a limiting conception. Whatever could be regarded as capable of further development was conceived as matter in relation to the process or function, etc., which would develop it further. But even within matter thus conceived one could really recognize something (a form) which distinguished it from a less developed entity. So that the distinction between matter and form is relative. But this relativity has its limits. Material objects cannot have less form than the so-called four elements. Nor can the forms of ordinary things exceed certain levels. A block of granite may assume the form of an image of some kind, but it cannot develop into a plant ; an acorn may eventually assume the form of an oak-tree, but not an animal ; and so on. Such considerations induced Aristotle to assume the fixity of species, though this did not prevent him from comparing the rich variety of things and noting what a wonderful ascending series, or " scale of nature," they constituted. The conception of such a " scale of nature," beginning with the limiting case of formless matter and ascending through richer and richer forms to the highest forms of life, led him to the conception of an upper limit or apex, a being so perfect that he cannot be regarded as matter for further development, and so could be conceived as form only. This being is God, whom (and whom only) Aristotle conceived in the manner of an immutable Platonic " Idea." God, according to Aristotle, is not the Creator, for matter and the forms are eternal, there being no break in the embodiment of the forms in matter. Yet, in some way, all things feel drawn towards God. He is the object of the world's desire, and by His mere presence lures objects to higher stages of development. He is the " unmoved mover " of the universe, and " it is love [for Him] that makes the world go round."

Intimately connected with Aristotle's doctrine of matter and form is his doctrine of the *four kinds of cause*. If we are to understand certain objects fully, then there are four things we must ascertain, namely, (*a*) their *material cause*, that is, the matter or stuff of which they consist, (*b*) the *formal cause*, that is, the form or law of their constitution or composition, (*c*) the *efficient cause*, that is, the agency through which the matter took on that form, and (*d*) the *final cause*, or the purpose which they serve. Aristotle explained that not all these kinds of causes are to be found or sought in all things ; some things are sufficiently explained by reference to the material and efficient causes alone. The physical sciences have advanced by confining themselves to these two kinds of causes. During many centuries, however, theologically minded thinkers were obsessed with " final causes," to the exclusion of the others. This tendency was intimately connected with the endeavour to prove the existence of God from the evidence of " design," which, it was alleged, could be observed everywhere. The progress of science was seriously hindered by this kind of explanation, which consequently fell into utter disrepute among the pioneers of modern science. But the abuse was contrary to the intentions of Aristotle, who did not look for " final causes " outside the field of biology, where some reference to " final causes " is still felt to be necessary. Aristotle, in fact, had sound views on the necessity of checking speculations by reference to observed facts. In one passage he refers to the necessity of " trusting our senses more than our reasonings, and our reasonings only when the results are in agreement with the facts."

In the history of science Aristotle is famous chiefly for his work in biology, which has elicited an expression of the highest praise from Darwin. The beginnings of scientific biology among the Greeks must be traced at least as far as the medical school of Hippocrates, in the fifth century B.C. Aristotle's father was court-physician to King Philip of Macedonia, to whose son, afterwards Alexander the Great, Aristotle acted for a time as tutor. The origin of Aristotle's interest in biology is thus obvious. It was in some ways a continuation of, though a very great advance on, the Hippocratic tradition. To Hippocrates, or his school, it may be pointed out incidentally, is due the doctrine of the " four humours," which to some extent still survives in popular thought and speech. According to this doctrine there are four kinds of " humour " (or juice) in the human body, namely, blood, phlegm, yellow bile, and black bile, and the temperament of each individual is determined by the preponderance of one of these " humours " over the others. There are thus four kinds of temperament, namely, the sanguine, the phlegmatic, the choleric, and the melancholic temperament, corresponding to the preponderance respectively of one of the four humours as enumerated above.

Aristotle's biological work was continued, in the field of botany, by his successor Theophrastus (370–285 B.C.). Otherwise very little original research was carried out in biology for many centuries afterwards.

Post-Aristotelian Thinkers

Greek philosophy continued for several centuries after Aristotle. But already in Aristotle's lifetime a certain change of spirit came over it. This was the result of the loss of Greek independence after the battle of Chæronea in 338 B.C. The troubles caused by the ascendancy of Macedonia left little inclination for pure philosophy. What people needed was some kind of moral or religious tonic. Accordingly, post-Aristotelian philosophy is predominantly ethical or religious in character. The Stoics, the Epicureans, and the Sceptics were all interested mainly in the moral problems of life, and in the last resort they all commended the same kind of ideal of conduct, namely, the cultivation of equanimity or peace of mind, and self-emancipation from the bondage of external circumstances. Apart from their ethical doctrines, the Epicureans are chiefly noteworthy for having embraced the atomic theory, the Stoics for their pantheism and cosmopolitanism, and the Sceptics for their anticipation of nearly all the important arguments subsequently employed by defenders of philosophic or religious doubt. The survival of Epicureanism for many centuries was chiefly due to its atomism; indeed, it was the Roman Epicurean, Lucretius (98–55 B.C.), whose poem *On the Nature of Things* gave classic expression to the atomic theory of antiquity.

Stoic pantheism, though partly a continuation of the philosophy of Xenophanes, was probably in part also among the first fruits of the new contact between Greeks and Orientals in Alexandria, which was founded by Alexander the Great, in 332 B.C., and eventually became the most important seat of science and philosophy in ancient times. The Stoics modified Aristotle's doctrine of matter and form into a doctrine of body and soul, and they conceived the universe as an organic whole having both a body and a soul. All finite things were treated as but parts of the " One and All," which was regarded at once as Nature and God, as Destiny and Providence. Nature was thus conceived as inspired by universal reason, and could readily be regarded as worthy of human imitation. Hence the Stoic ideal of " life according to nature." As a corollary to their pantheism they pleaded for universal brotherhood. " All men [said Epictetus] are brethren, and God is the Father of all."

The influence of the East is more marked in that blend of philosophy and religion known as Neo-Platonism. The system of Greek philosophy which had the strongest leaning towards religion was that of Plato. Platonism accordingly served as a link between Western philosophy and Eastern religion when the two came into close contact in Alexandria. The most famous of the early Neo-Platonists was Philo Judæus of Alexandria (*c.* 25 B.C.–A.D. 50), who attempted to harmonize Hebraism and Platonism. To this end he interpreted the Bible allegorically, and identified the Platonic " Ideas " with Spirits mediating between God and man. The allegorical method proved too cumbrous, and Neo-Platonism owed its success mainly to Plotinus (204–270) and Proclus (410–485).

In the realm of science the Alexandrians made considerable advances, especially in mathematics, pure and applied. The ground had been prepared for them to some extent. The Egyptians and Babylonians already had made considerable progress in the art of calculation and mensuration. The earliest extant mathematical treatise is an Egyptian papyrus (now in the British Museum, and named the Rhind Papyrus after its donor) copied about 1600 B.C. from a much older original. From this it is clear that the Egyptians could manipulate large figures, measure land, estimate the contents of barns, etc., at an early date. So could the Babylonians. But the Greeks took up these studies in a more scientific spirit, formulating and proving general theorems instead of dealing only with concrete instances. Thales, Pythagoras, Hippocrates (not the father of scientific medicine), Plato, Eudoxus, Aristotle and others contributed to the development of Geometry, which Euclid of Alexandria (330–275 B.C.) systematized in his classical " Elements," which remained *the* class book of geometry for more than two thousand years. Other Alexandrians, notably Aristarchus, Archimedes, Apollonius, Hipparchus, Ptolemy, Pappus, Diophantus, Proclus, and others carried mathematical studies some stages further, especially in connection with its application to astronomy, optics, mechanics and engineering.

The Alexandrians also made important contributions to Astronomy. Here likewise the ground had been well prepared. Long before the Greek period the Babylonians, and more especially the Chaldeans, paid close attention to the heavenly bodies. Their motives were mainly religious and astrological, but they accumulated much valuable information all the same, and many of our Western ideas and practices are derived from them. It was they who first observed the seven planets and associated them with a seven-day week, each day being called after one of the planets, and divided into twenty-four hours. They also divided the zodiac into twelve divisions or constellations, and associated them with the twelve lunar months. They were the first to discover that the evening star and the morning star were the same. And they instituted a system of regular astronomical observations, under the direction of Astronomers-Royal, thousands of years before such things were thought of in the West. Indeed, one of their records of a solar eclipse in the year 1062 B.C. was actually made use of, in recent years, by the astronomer Cowell in order to rectify the lunar theory. As the result of their long and regular astronomical observations, the Babylonians acquired already in early times an accurate knowledge of the periods taken by the sun, moon, and the other five planets then known, to complete their orbits, and so could foretell the position of each among the stars, and predict the occurrence of solar and lunar eclipses. But they regarded heaven as a solid stationary vault and the earth as a stationary mountain round which the stars moved, and in whose hollow part was the abode of the dead. Some of their ideas were taken over by the Greeks as well as by the Egyptians. The belief in a stationary, and usually a flat, earth survived for a long time even among the Greeks. Anaximander, however, already rejected the belief that the earth rests on a base of indefinite depth. He maintained that the earth floats free in space, and that the sun, when it sets in the west, continues to move to the other side of the earth. Anaxagoras (500–428 B.C.) gave the correct explanation of eclipses, the phases of the moon, and partly also of the Milky Way. Some of the Pythagoreans, moreover, conceived the earth to be a sphere, in fact a kind of star moving like the sun, moon, etc., round a fire placed at the centre of the universe. This was the first rejection of the geocentric theory, but did not yet amount to a heliocentric theory. It was Aristarchus (310–230 B.C.) who first proposed the hypothesis that the sun is the fixed centre round which the earth moves in a circular orbit while rotating at the same time about its own axis. But the heliocentric theory did not gain acceptance until it was revived by Copernicus nearly eighteen centuries later, and only very gradually even then. In the meantime various Greek astronomers attempted to determine the geometry of astronomical phenomena on the basis of a geocentric theory, and on the assumption that all heavenly bodies move in orbits which are either circular or are compounded of circular motions. The greatest mathematical ingenuity was displayed in various attempts "to save appearances" in celestial phenomena. Among the most familiar devices employed were those of concentric spheres with axes of varying directions; epicycles, or circular orbits round a centre which is itself moving in a circle; and eccentrics, or circular orbits whose centre is at some distance from the earth. By all these devices it was attempted to retain the belief in the circular orbits of the heavenly bodies in spite of their apparent irregularities. The whole of Greek astronomy was systematized by the Alexandrian Ptolemy (second century A.D.), whose treatise *Syntaxis* (also known as *Almagest*) remained the standard work on astronomy until the time of Copernicus and even later.

Turning next to the science of Mechanics, it is obvious from the buildings constructed by the Babylonians and Egyptians (their palaces, temples and pyramids) that practical mechanics had made great advances long before the Greek period. But into this study likewise the Greeks were apparently the first to introduce a scientific spirit. The foundations of this science appear to have been laid by Aristotle, who propounded some of the fundamental principles of the subject, though he did not express them very happily. The most important contributions to the science were made by Alexandrians, and especially by Archimedes (287–212 B.C.). He formulated correctly the principles of the lever, of the pulley, and of the centre of gravity of bodies. He discovered the principles of specific gravity, and of the equilibrium of floating bodies. And his inventions include the water-screw for raising water. The work of Archimedes was continued to some extent by other Alexandrians, notably by Ctesibius and Hero, whose energies, however, were mainly directed to the construction of apparently wonder-working inventions.

Chemistry, too, was actively studied by the Alexandrians. In ancient Egypt, it had been a secret art practised by priestly adepts and largely empirical in nature; in Greece philosophers and craftsmen lived in different worlds; but in Alexandria the practical knowledge which had been handed down from ancient Egypt came into active contact with Greek thought, and in this fusion of practice and theory the science of chemistry had its beginning. The Alexandrian chemists, observing that matter underwent many remarkable changes, concluded that it was transmutable. Their theory of matter was thus like that of Aristotle, but was supported to some extent by experiment. The influence of the Neo-Platonists ultimately caused Alexandrian chemistry to become mystical and to encourage the belief in the "philosopher's stone," which was alleged to turn base metals into gold or silver, and in the "elixir" or "panacea," which was supposed to cure all diseases. Their writings abound in signs and symbols, used to preserve secrecy, the breach of which was punished with death. Their experimental results were too slight to support their far-reaching theories.

In 47 B.C. the Romans took possession of Alexandria, and its glory began to decline. The Romans had a genius for all things connected with imperialism, notably for law, administration, and engineering. But pure science did not appeal to them. Yet the annals of the history of science and philosophy contain some Roman names of distinction. The most important of these must be mentioned. Cicero (106–43 B.C.) had a masterly knowledge of the philosophical systems of his predecessors, and his writings did much to keep alive some interest in philosophy during the dark centuries that were to follow. Lucretius (98–55 B.C.) has already been referred to as the classical exponent of the atomic theory of antiquity. Vitruvius (flourished about 14 B.C.) wrote the best ancient work on architecture and building (*De Architectura*). Strabo (*c.* 60 B.C.–A.D. 24) was an eminent traveller and geographer. Pliny the Elder (A.D. 23–79) wrote a famous *Natural History* in which some 20,000 topics are discussed, and nearly all the knowledge of antiquity, and many of its superstitions, are collected. Frontinus (A.D. 40–103), at one time Roman Governor of Britain, was the author of a notable work on *The Waterworks of Rome*. The Emperor Marcus Aurelius (A.D. 121–180) was a philosopher of distinction, and perhaps the most famous Stoic. His court physician Galen (*c.* A.D. 130–200), a native of Asia, but a Roman by adoption, was next to Hippocrates probably the most renowned doctor of antiquity, and his works served as a Doctors' Bible for many centuries. Lastly, Boethius (480–524) was the author of the widely read *Consolations of Philosophy*, and his various works served, for many centuries, as repositories of the rudiments of a liberal education.

In the meantime Christianity had come on the scene and grown powerful. Its gospel was a gospel for the lowly, and it was rather hostile towards the "high-brow." Of philosophy and science it was frankly contemptuous, and some of the Apostolic Fathers, like Tertullian, not only did not mind being unphilosophical in their faith, but seemed rather proud of it. In defence against hostile critics, however, it was found advisable to employ a certain amount of philosophical argument, and so the apologetic literature of the Patristic period is tinged with a certain amount of Platonic or Neo-Platonic doctrine like that of the "Logos." Moreover, some of the early Fathers, notably St. Augustine (A.D. 354–430), had been thinking pagans before they became believing Christians, and could not entirely abandon their philosophic interests. But the general attitude of the Christian Church towards philosophy and science was decidedly hostile. In 390 Bishop Theophilus destroyed one of the libraries of Alexandria. In 415 Hypatia, the daughter of Theon the astronomer, and herself a teacher of mathematics, was brutally murdered in Alexandria by a mob of Christian fanatics. And to crown it all the Emperor Justinian had all schools of philosophy closed in 529. The first great period in the history of human thought thus came to an end, leaving the West to darkness and the Church.

THE MIDDLE AGES

Moslem Philosophers

When the Athenian schools of philosophy were closed by Justinian, many of the teachers migrated to Syria and Persia, where they were safe from Christian persecution. Their advent there stimulated a certain amount of interest in philosophy and science, which was considerably intensified in the next century when Alexandria was captured by the Arabs (641). By 711 Islam had swept through Arabia, Syria and Mesopotamia, on the one hand, and along the north coast of Africa, as far as the Straits of Gibraltar, on the other. From here the Moors (that is, the Arabs of Mauretania or North Africa) crossed over into Spain. In this way philosophy and science found their way back to Europe through Moslem channels.

The most important Moslem philosophers were Al Kindi (d. 870), Alfarabi (d. 950), Avicenna (980–1037), and Averroes (1126–1198). Of these the first three lived in Bagdad, the last in Cordova. They knew most of the works of Aristotle, and some of the works of Plato. Their philosophy was Aristotelianism tinged with Platonism. It is interesting to note that Avicenna first gave prominence to the question of the relation between the universal and the particulars subsumed under it. This problem soon became the bone of contention among the Scholastics, whose ranks it divided into Nominalists and Realists, according as they regarded universals as mere names, and particulars as the only realities, or held that universals had an existence of their own apart from the particulars. The most influential, and most Aristotelian, of these Moslem thinkers was Averroes. According to him there is a perfect, eternal world beyond the stars, besides our sub-lunar world of imperfection and change. Matter is eternal and contains seminal " forms " which transform it into its final states under the influence of higher " forms " (or " intelligences ") or, in the last resort, of God. The soul of man is inseparable from his brain, and perishes with it. But the Reason that dwells in man is immortal. By cultivating this Reason, man may enter into union with the universal and eternal " Active Reason." The popularity of Averroes' commentaries on Aristotle is attested by the fact that the Schoolmen afterwards referred to him as " *the* commentator," just as they called Aristotle " *the* philosopher."

Jewish Philosophers

Side by side with the Moslem philosophers there were a number of Jewish thinkers who likewise helped to keep philosophy alive, or even to develop it to some extent, and who in due course mediated between Islam and Christendom when the latter was ready to resume an interest in philosophic problems. From early times some Jews took an interest in philosophy. Traces of this are to be found in the Bible already. In Alexandria there appears to have been a whole school of Jewish philosophers, whose influence may be traced in the Greek translation of the Bible (the Septuagint) and in the Sibylline Oracles. Mention has already been made of Philo Judæus, the best known among them. This interest in philosophy was revived when the Jews were living under favourable conditions in Moslem centres of culture like Bagdad and Cairo, Cordova and Toledo. They maintained a friendly rivalry with their learned neighbours. Almost every school of Moslem (or Græco-Moslem) thought found its parallel in contemporary Jewish thought—Platonism and Aristotelianism, traditionalism and modernism, dogmatism and rationalism, fatalism and voluntarism. The leading Jewish thinkers of this period were Israeli (between 850 and 950), Saadyah (892–942), Bachyah (*c.*1000–1050), Ibn Gabirol (*c.*1020–1070), Maimonides (1135–1204), Gersonides (1288–1344), and Crescas (1340–1410). The Jewish philosophers played no small part in the subsequent renascence of philosophy in Christendom. They helped with the Latin translation of Greek and Arabic treatises on philosophy, and they influenced the thought of the leading Scholastics. Gabirol's *Fountain of Life* helped to mould the thought of Duns Scotus, among others; and Maimonides' *Guide of the Perplexed* influenced

Albertus Magnus and Thomas Aquinas, among others. Maimonides and Crescas also had a share in the shaping of the philosophy of Spinoza.

The Scholastics

The revival of Christian interest in philosophy may be traced to some extent to the beneficent results of the educational work of Charles the Great, who founded schools throughout France in the eighth century. The subjects gradually introduced into these schools consisted of the so-called " seven liberal arts," namely, grammar, logic, rhetoric, arithmetic, geometry, astronomy, and music. The teachers who taught them were known as *doctores scholastici*. When in the course of the eleventh and twelfth centuries the new Universities of Paris, Bologna, Salerno, Oxford and Cambridge were founded, the name *Scholastics* (or Schoolmen) was extended to all who taught philosophy and theology there. The main motive of the Scholastics was to reconcile Christian theology with philosophy. The early Scholastics, John Scotus Erigena (810–877), Roscellinus (*c*.1051–1121), St. Anselm (1033–1109), and Abelard (1079–1142) inclined towards Platonism. In the course of the thirteenth century, however, as the works of Aristotle became better known, his philosophy grew in favour in the Church, especially with the Dominican order, which turned out the two most eminent Aristotelian Schoolmen, Albertus Magnus (1103–1280) and St. Thomas Aquinas (1225–1274). Albertus Magnus appears to have been the first to draw the line between *natural* knowledge and *theological* knowledge, that is to say, between the light of reason and the light of revelation. This distinction, though objectionable in some ways as implying a breach in the unity of the universe, served for a long time the very useful purpose of securing some measure of freedom for philosophy and science, which the Middle Ages were only too prone to treat as mere handmaids to theology or the Church (the realm of grace as distinct from the realm of nature). St. Thomas Aquinas stressed the Aristotelian distinction between matter and form, but went far beyond Aristotle as regards the number of " forms " to which he attributed an existence independent of matter. The human soul, though associated for a time with a body, is, according to Aquinas, capable of separate existence. And Aquinas postulated a whole scale of such " separate forms," beginning with the human soul, passing through a whole hierarchy of angels and spirits (some of which guide the stars in their courses) and culminating in God, who is the " Absolute Form." By his doctrine that God had endowed nature with a certain amount of autonomy, Aquinas supported the tendency, initiated by Albertus Magnus, to allow philosophy and science (that is, " natural " knowledge) some measure of autonomy. This tendency was further encouraged by Aquinas's theory of Knowledge. For whereas St. Augustine had treated all knowledge as the result of divine illumination, Aquinas regarded it as partly the product of images produced in the soul by external objects, and thus allowed some importance to the empirical study of natural phenomena. He held that material objects *qua* particular objects become known through the senses, but their " forms " become known through the intellect.

The Franciscan order showed great hostility to the Aristotelianism of the Dominicans. Their principal spokesmen, Duns Scotus (1265–1308) and William of Occam (d. 1349), repudiated any attempt to harmonize theology with philosophy, or faith with natural knowledge. What is true for natural knowledge (that is, for science and philosophy) may be quite false in theology, and theology is supreme. They repudiated the intellectualism of Aquinas, and laid stress on the will as the fundamental faculty of the soul. The good is placed above the true, and the good is whatever God has arbitrarily decreed. God has not decreed certain things because they are intrinsically good ; rather they are good only because He has decreed them. And it is man's duty to obey God. Even so-called evil deeds are good if they are done in the service of God. As the decrees of God are made known by the Church, all that was thus claimed for God was really claimed for the Church, whose authority and power were supreme throughout the Middle Ages, and more or less effectively repressed all freedom of thought.

Mediæval Science

The story of science in the Middle Ages is naturally very similar to that of philosophy. Such contributions as were made to the survival and development of science were due mainly to the Orientals, touched mostly by the spirit of the ancient Greeks. In the seventh century our system of numerals was discovered or invented in India. Its importance can hardly be exaggerated. About 900 it was adopted by the Arabs, who introduced it into Europe, where it first came into vogue about 1200. In the ninth century the Arabs also took in hand translations of the most important Greek works on science. In due course they had Arabic versions of the medical works of Galen, Euclid's *Elements* of geometry, and Ptolemy's astronomical masterpiece, known as *Almagest*, from the Arabic version. Acquaintance with these and other scientific treatises stimulated Moslem interest in science. Al Batani, in the latter part of the ninth century, carried on fruitful work in his observatory at Antioch, recalculating the precession of the equinoxes and preparing new astronomical tables ; and about a century later Ibn Yunus made important contributions to the study of solar and lunar eclipses. The Moslems built a number of observatories, including the one at Seville, which was the first European observatory. In medicine Rhazes of Baghdad (tenth century) and the philosopher Avicenna did work of distinction. Avicenna's *Canon* was used as a textbook of medicine in various European Universities till late in the seventeenth century. In physics Ibn-al-Haithan (965–1020) carried out valuable experimental work in optics. Al Biruni (973–1048) determined the specific gravity of precious stones, and carried out various geodetic measurements. He and Omar Khayyám, the poet, also wrote treatises on mathematics. But of all the sciences chemistry perhaps owes most to the Arabs. The best known of their chemists was Jabir, who is sometimes called the father of scientific chemistry. He lived in the eighth century most probably, but is sometimes identified with, and sometimes distinguished from, a certain Geber, who may have lived later. His great merit was his insistence on actual observation, as distinguished from hearsay and book-lore. He carried out many experiments in distillation, filtration, sublimation, and calcination. He gave careful accounts of these chemical processes, and appears to have been the first to notice that metals heated in an open vessel gain in weight. His name is especially associated with a new conception of metals, namely, that they are all the products of sulphur and mercury combined in different proportions, and that, inasmuch as they have the same constituents, they can be transmuted one into another. In the subsequent history of mediæval chemistry these ideas played a great rôle. Transmutation of base metals into precious ones was a common quest; and the " principles " of sulphur and mercury (to which, later on, salt was added) took their place beside the " four elements " of earlier thought. Another famous Moslem chemist was the above-mentioned Rhazes. He was more systematic than Jabir, and made an attempt at an elaborate classification of chemical substances. First he classified them into the familiar three classes, animals, vegetables, minerals, and then subdivided each of these into a number of sub-classes. He also gave a full account of the apparatus needed in the study of chemistry. Like Jabir, he believed in transmutation. Apparently the philosopher Avicenna was one of the few mediæval thinkers who rejected the possibility of transmuting metals. But there was a whole succession of Moslem chemists who were really scientific. The debt of subsequent European science to the Arabs is evidenced by the number of Arabic expressions which gained currency in other languages—alchemy, alembic, algebra, azure, elixir, zenith, zero, etc. It is also shown by the fact that when Roger Bacon commenced his crusade in favour of scientific research, he attached great importance to the study of Arabic and Hebrew, as well as Greek, as a means of access to the scientific knowledge already accumulated.

Perhaps the chief stumbling-block in the way of mediæval thought consisted of certain distortions of Platonic and Aristotelian doctrines. In his *Timæus* Plato had suggested that the great world (the macrocosm) is really alive, and that man is in some ways a small model of it (microcosm). This was developed in the Middle Ages into extravagant attempts to correlate parts of the great world (the planets, etc.) with parts of the microcosm (parts and organs of the human body). This ended in weird astrological and mystical fancies. Aristotle's doctrine of " forms " was similarly distorted or even more so. The Neo-Platonists and even some of the Aristotelians (see, *e.g.*, the above account of St. Thomas Aquinas p. 18) identified the " forms " of things with their " souls " or " spirits." This encouraged the mystical treatment of " forms " as occult powers which might accomplish anything, and which could therefore be conveniently resorted to to explain everything. In this way " forms," " occult powers," and " principles " helped to build up a pseudo-science which stood in the way of genuine, empirical science. Much of the time and energy of the pioneers of modern science (see, *e.g.*, Robert Boyle's *Sceptical Chymist*) was taken up in exorcising these spirits.

Transition

Even the Middle Ages, however, had quite a number of searchers who were imbued with the true spirit of science. So far as Christendom is concerned, the two most famous men of this type were Roger Bacon (*c.*1214–1292) and Leonardo da Vinci (1451–1519). Bacon appears to have obtained most of his ideas from Arabic, Greek, and Hebrew sources, but, though not entirely free from mediæval fancies, caught the scientific spirit, and did his best to apply it himself and to persuade others to use the scientific methods of observation, experiment and verification, instead of relying on books and other authorities. His works were condemned by the general of the Franciscan order, to which he belonged. He therefore had little opportunity of exercising much influence. Da Vinci was a universal genius, whose influence might have been great enough to inaugurate the modern revival of science about a century earlier than its actual commencement. But, for reasons not difficult to surmise, he refrained from publishing his scientific researches.

The Renaissance and the Reformation, as such, afforded no direct help to the revival of either philosophy or science. The Renaissance, with its predominant interest in classical literature as such, gave no direct encouragement to a first-hand study of nature. Indeed, classical learning obtained such a hold on the Universities that these showed little love for science, and new societies (like the Royal Society, for example) had to be started for the encouragement of experimental science. Indirectly, however, the Renaissance helped to shake Europe out of its authoritarian torpor by acquainting people with the freer, more naturalistic spirit of the classical age, which the invention of the printing press (1455) helped to propagate. As to the Reformation, the reformers were just as intolerant as the Catholic Church, if not more so. Indirectly, however, the squabbles of the Churches had the effect of turning some of the best minds away and setting them on the path of a quest after truth independently of the rival Churches and the authority which they all claimed.

The most obvious feature of mediæval thought was its subordination to authority—the authority of the Church, in the first instance, and of such books as the Church favoured. As the Church encouraged little interest in this world, and stood primarily for supernaturalism, it had helped to reinstate something very like the mythological age which had preceded the birth of science and philosophy. The revival of science which marked the beginning of the modern period was concurrent with the revival of naturalism and the gradual repression of supernaturalism. The growth of interest in natural phenomena as such, and of the habit of direct observation of them, instead of accepting the accounts of authorities, was slow. Still, the idea was on the march. Some of the milestones may be indicated as follows. Lorenzo Valla (1408–1457) openly attacked Scholasticism for its interest in words instead of in things. Nicolaus Cusanus (1401–1464) showed scientific leanings, and openly accepted the view that the earth is spherical and rotates about its axis. The voyages of discovery in the fifteenth and sixteenth centuries (Columbus, Vasco da Gama, Magalhaes) helped to spread this view, and widened people's outlook. Paracelsus (1493–1541) and Van Helmont (1577–1644) denounced authority and book-lore in the study of nature. Telesio (1508–1588) founded an academy in Naples for the empirical study of natural phenomena. The martyrdom of Servetus in 1553, and of Giordano Bruno in 1600, helped to make manifest the hostility of the Churches (Reformed as well as Catholic) towards the naturalist spirit of science. Montaigne (1533–1592) and Sanchez (1562–1632) met dogmatism with scepticism, and advanced the cause of toleration. Francis Bacon (1561–1626) summed up all the faults of mediævalism. His persuasive pen and important position did much to prepare the way for the new scientific age, of which he proclaimed himself the herald. But most effective of all was probably the work of Copernicus (1473–1543). Slowly but steadily his book *On the Revolution of the Celestial Orbits* (1543) induced thoughtful people to abandon the geocentric theory of the universe. And when the earth was once relegated from the position of cosmic centre to that of a minor planet of the sun, it was felt to be impossible to continue to regard man as the crown of creation, or as the hero of the whole cosmic drama ; so Church mythology was shaken to its foundations. In a more modest, yet positive and valuable, manner, Vesalius (1515–1564) likewise contributed to the new birth of science. His book on *The Structure of the Human Body* (published in the same year as Copernicus' revolutionary treatise) set a good example of a sober, objective study of man based on direct observation, instead of on authorities, and refraining from all speculations about alleged correlations between the planets, etc., and the parts and organs of the body, between the macrocosm and the microcosm. Supernaturalism, the great enemy of science, was being steadily excluded from the study of natural phenomena. The spirit of modern science had arrived.

MODERN TIMES

The advance of science, in modern as in ancient times, meant an extension of the realm of natural knowledge and the steady repression of the claims of the supernatural. The work of science consists essentially in the discovery of order among the phenomena of nature. It seeks to formulate the laws inherent in natural events, and to account for them without recourse to whatever is merely magical or mysterious, mythological or supernatural. But the human mind is so deeply attached to myth and wonder that some of the greatest pioneers of modern thought could not entirely emancipate themselves from the bonds of the supernatural, and their successors have repeatedly succumbed to its lures. Compromise between the two loyalties has been, and still is, rather common. And the commonest type of compromise resorted to consisted in being strictly scientific on weekdays and supernaturalist on Sundays, or scientific in writing on astronomy, physics, chemistry, etc., and supernaturalist when writing on philosophical and religious subjects. Still, not all suffered from such divided personality, and even those who did advanced, in spite of themselves, the great cause of natural knowledge.

Seventeenth Century Science

The most impressive movement with which modern thought began is probably to be found in that steady, irresistible, almost fate-like march of astronomy from Copernicus to Newton. The final outcome of this development was vastly to reduce the traditional differences between heaven and earth. On the one hand, the earth ceased to be regarded as the central stage of the cosmic drama ; on the other hand, the celestial bodies, once conceived to be composed of a special kind of element (quintessence) and deified by many (even by Kepler !), were shown to be subject to the same material conditions (especially gravitation) as the earth. In the eyes of some people, at all events, all this tended to thrust the supernatural out of ken. Hence the stubborn resistance with which the Churches opposed the relentless march of the new astronomy with its implicit naturalism.

Galileo (1564–1642) probably deserves the chief credit for the great step forward in the emancipation of science from mystification. Copernicus died soon after his book was printed, and the book itself was put on the Index. But for Galileo's whole-hearted (if slightly disguised) championship of the Copernican theory, its day would have been long delayed. His own important discoveries added enormously to the momentum of the whole movement. His telescope revealed the earthy appearance of the moon with its mountains and valleys, and the spots on the sun, thus shattering traditional beliefs in the perfection of celestial bodies. His observation of Jupiter and its satellites furnished a striking parallel to the solar system as represented by the Copernican theory. Moreover, by his conception of inertia he succeeded in explaining away most of the difficulties which appeared to stand in the way of the Copernican theory.

Tycho Brahe (1546–1601) had in the meantime made the most important advance in the accuracy and number of his astronomical observations. His work set a most valuable example of ingenuity in the construction of scientific instruments, of patient devotion to the closest and continuous observation of phenomena, and admirable restraint in letting speculation wait for an adequate accumulation of data. By way of compromise between the heliocentric and geocentric theories he suggested the possibility that the sun and the moon move round the earth, while the other planets move around the sun. This view may have served as a halfway house for some people, until they could go all the way.

Kepler (1571–1630) offers a remarkable instance of a mathematical enthusiast and mystic converted gradually into a sober scientist. Embracing the heliocentric theory he went into ecstasies about the Sun, calling it God the Father. And he was almost beside himself when he thought he had discovered a correlation between the orbits of the planets and the five regular solids—a correlation to which he at first ascribed great mystical significance. But persistent work in science sobered him, and led him to such important real discoveries as made him the immediate forerunner of Newton. Kepler was acting as Tycho Brahe's assistant when Tycho died. Kepler received Tycho's vast collection of data, and set about the task of interpreting them. The main result of his life's labours consisted in the formulation of the famous three Laws of Kepler. They are the following. (1) The planets move in elliptic orbits having the sun in one focus. (2) A planet moves not uniformly but in such a way that the straight line joining its centre to that of the sun (the radius vector) sweeps out in its orbit equal areas in equal times. (3) The squares of the times which the several planets take to complete their orbits are proportional to the cubes of their mean distances from the sun. Kepler not only dealt with the geometrical and temporal aspects of planetary motion, but for the first time in the history of human thought he attempted to give an account of the mechanics of the movements of the planets. Influenced by the work of Gilbert on magnetism, and his proof that the earth is a huge magnet, Kepler suggested that the sun emits lines of magnetic force which act tangentially on the planets and keep them moving in their elliptic orbits.

What with Galileo's three laws of motion and other discoveries, Kepler's three laws of planetary movement and Descartes' new mathematical methods (Analytical Geometry), the materials were prepared for the first great synthesis of physical phenomena. For the time being all these discoveries, important as they were, seemed to be entirely disconnected, and to have no obvious bearing on one another. It needed the penetrating eyes of a synoptic genius to see the single system of which they all formed so many aspects. Fortunately for the history of science the hour produced the man.

Newton (1642–1727) was born in the year in which Galileo died, and was the first to appreciate fully the significance of Galileo's three laws of motion, which in due course gained universal acceptance in the formulations which Newton gave them. Now the chief novelty of the new astronomy was the attempt to explain the mechanics of planetary movement, all the astronomers up to the time of Kepler having confined their attention to the geometry (that is, the precise shape of the orbits) of the motions of the planets. Of course even as regards this geometrical problem, Kepler's laws marked an advance of the utmost importance, but his attempt at a planetary mechanics, though a hopeless failure, was an entirely new departure. His example in this respect was followed by Descartes, who suggested the rival hypothesis of vortices, or enormous whirlpools, for the conveyance of the planets along their orbits. Now Newton was greatly drawn by the mechanical problems of astronomy, but his firm grasp of Galileo's first law of motion (namely, if no force acts on a body in motion, it continues to move uniformly in a straight line) convinced him that Kepler was on the wrong track, because he assumed that some force was required to *maintain* a body in motion, whereas Galileo had shown that force was only necessary to *change* its motion. What really needed explanation was not the continued motion of the planets, but only their deviation from a straight path. What causes the *curvature* of the orbits? Newton concluded that there must be some centripetal force which pulls the planets towards the sun. Such a centripetal force would account for the transformation of an initial straight path into a curved one. Now the intensity of a force emanating from a centre would naturally vary inversely with the square of the distance from the centre, because the force radiates or gets dissipated into larger and larger spheres, and the surface of a sphere varies with the square of its radius. But, as Newton showed, movement in an elliptic orbit implies an inverse square law. Thus the assumption of a centripetal force situated in the sun would account for the elliptical orbit of the planets, which Kepler's first law formulated merely as a brute fact. The same assumption, moreover, would account also for Kepler's second and third laws. The next thing to ascertain, if possible, was the nature of this centripetal force. According to the familiar legend, which ought to be true if it is not, it occurred to

Newton, while he was watching the fall of an apple, that the force which pulls the moon towards the earth, and the earth and the other planets towards the sun, might be the same force as that which pulls the apple to the ground, namely, gravity. And his calculations eventually led him to formulate the Universal Principle of Gravitation, namely, that every particle of matter attracts every other particle of matter with a force varying directly as the mass and inversely as the square of the distance.

The Law of Gravitation was the most comprehensive discovery that had yet been made, and retained its hold for several centuries. In one grand generalization it embraced all the physical phenomena of the universe, explaining such diverse phenomena as the fall of an apple, the movements of the tides, the shape of the earth, the motion of the moon round the earth, of the Medicean stars round Jupiter, of the earth, Jupiter and the other planets round the sun, and even the apparently erratic movements of comets, etc. Naturalism had achieved a great triumph, and repudiated the necessity of drawing any hard and fast line between terrestrial and celestial phenomena.

Although the astronomical advance of the seventeenth century almost overshadows all its other scientific discoveries, it made, of course, other important contributions to science. At least some of these must be indicated here.

In one form or another the atomic theory was revived. Descartes, indeed, had a theory of infinitely divisible matter not inherently mobile, which was very different from the atomic theory of the ancients. But Gassendi (1592–1655), Boyle (1627–1691), and Newton embraced the old atomic theory in its essentials, with the metaphysical reservation that the atoms were created by God and endowed by Him with motion and their other properties. For the time being the main significance of this "corpuscularian philosophy," as Boyle called it, lay in the fact that it helped to displace the traditional " four elements " and " three principles " (*tria prima*) and the " forms " and " occult qualities " which obstructed the path of scientific chemistry. Boyle, indeed, confessed that he could not see " how from matter, barely put in motion, and then left to itself, there could emerge such curious fabricks as the bodies of men and perfect animals, and such yet more admirably contrived parcels of matter as the seeds of living creatures." He therefore assumed an " architectonick principle or power " to account for it. The problems of vitalism and biochemistry, however, did not become urgent for a long while yet. And in the meantime inorganic chemistry could advance unimpeded.

So far as biology was concerned, the most important contribution of the seventeenth century was Harvey's discovery and experimental proof of the circulation of the blood. Descartes, indeed, attempted to treat the lower animals and even the human body as automata, and to describe all their physical activities mechanically. But his adherence to Galen's doctrine of animal and vital spirits, with their somewhat ambiguous position between physical and mental entities, seemed to open a back door for occult or quasi-occult influences. Harvey's discovery of the circulation of the blood, and his account of it in more or less purely mechanical terms, helped to put biology on a naturalistic basis.

In physics the most important discoveries related to optics. Snell discovered his law of refraction in 1621. Descartes tried to explain all the phenomena of light on the analogy of the mechanics of moving particles. Roemer discovered the velocity of light in 1676. Newton made his classical experiments on the composite character of white light. And Huygens formulated the undulatory theory of light, which was destined to have such far-reaching consequences in the nineteenth century.

But perhaps most promising, in some ways, were certain important aids which the seventeenth century created for the subsequent advance of science. First of all there were certain advances in mathematics—the most potent intellectual tool of science. Napier invented logarithms. Descartes invented Analytic Geometry. Pascal (1623–1662) formulated the mathematical theory of Probability. Lastly, Leibniz and Newton invented the Infinitesimal Calculus, which provided the basis for nearly all subsequent discoveries in mathematics. Next to the intellectual tools must be mentioned the invention of certain material instruments which rendered possible that fruitful observation and experiment, and that accurate measurement of phenomena, on which science is based. The telescope was invented by a Dutch spectacle-maker at the beginning of the seventeenth century. Its adjunct, the micrometer, was constructed by Gascoigne about 1639. The microscope was invented about the same time. Guericke (1602–1686) invented and Boyle improved the air-pump. The thermometer was invented by Galileo, and improved by the members of the Accademia del Cimento, who introduced the method of hermetically sealing it, and by Renaldini, who in 1694 showed how the melting point of ice and the boiling point of water might be used as fixed points for a thermometric scale. Torricelli (1608–1647) invented the barometer in 1643, and Pascal demonstrated its accuracy, and so laid the ghost of the old superstition about nature's abhorrence of a vacuum, by which the action of pumps used to be explained. Huygens invented the pendulum clock. Finally, mention must also be made of the foundation of various academies which were formed for the express purpose of promoting scientific research. Rome had the Accademia dei Lincei. In Florence the Accademia del Cimento was founded in 1651. The Royal Society of London received its charter in 1662, though its beginnings go back to 1645. And the French Académie des Sciences was founded in 1666.

Seventeenth Century Philosophy

The differentiation between science and philosophy came into vogue only gradually, and largely in consequence of Newton's distinction between scientific inferences drawn direct from observations and metaphysical " hypotheses " which went beyond, and in which he declined to indulge in his capacity of astronomer and physicist. In the seventeenth century the line between science and philosophy was still very fluid, though there was a tendency to mark off the sciences as " natural " philosophy from the rest of philosophic thought. If it is not altogether easy to draw the line between mediæval and modern science, it is even less easy to draw the line between mediæval and modern philosophy, using the term philosophy in the later and more restricted sense of the term (*i.e.* as exclusive of the sciences). But we may begin with Descartes, whose philosophy, though Scholastic in many respects, marked a new departure in some ways.

Descartes (1596–1650), like others before him, was keenly dissatisfied with the state of knowledge in his time. The only study which appeared to him well-founded was mathematics. This, he thought, was due to the method employed in mathematics, which sets out from clear ideas (axioms, definitions, postulates) and proceeds deductively to indubitable results. So he wanted to introduce the mathematical method into philosophy. For this he needed first of all a sure starting point. To find this he resorted to St. Augustine's " methodical doubt," and, like him, found that though he might doubt everything else he could not doubt the reality of his own doubt. " I think, therefore I am." Now, why is this accepted as certain ? Because it is " clear and distinct." If so, he gets the general principle that " whatever I apprehend very clearly and distinctly is true." And among such clear and distinct, and therefore true, ideas he includes those of God, the axioms of geometry, and such " eternal truths " as that " nothing can result from nothing." Nevertheless Descartes found it desirable to *prove* the existence of God ; and for this purpose he drew mainly on the arguments of St. Anselm and Campanella. Next, relying on the veracity of God, whose perfection would refrain Him from deception, Descartes accepts the reality of the world of experience in so far as this is very clear and distinct. This world is the creation of God, and is entirely dependent on Him also for its continuance. The created world consists of two main classes of things, namely, bodies (or " extended things ") and minds (or " thinking things "). Like St. Augustine, Descartes regarded bodies and minds (or souls) as so utterly different that there can be no interaction between them. The union of body and soul in man is just a miracle. With the miraculous aid of God the soul can *direct*, though not *produce*, the movements of the body. This supernaturalist strain in Descartes' philosophy soon developed into " Occasionalism," that is, the doctrine that body and soul exercise no influence whatever on each other, but that any change in either serves as an occasion for divine intervention to produce a corresponding change in the other. In his scientific work Descartes followed the mechanistic lead of Galileo. He even tried to explain animal organisms (including the human body) as mere automata or machines. His most original and valuable discovery was that of Analytic Geometry.

Hobbes (1588–1679) was strongly opposed to supernaturalism. He attempted to apply to the whole world of reality the kind of mechanistic explanations which Galileo and Descartes had applied to physical phenomena only. His naturalism thus assumed the extreme form of materialism. According to it matter and motion are the sole ultimate realities, and account for everything, even for human knowledge. For all knowledge is derived from sensations, and all sensations are produced by the pressure of matter on the sense organs. In fact sensations and even thoughts are only certain kinds of motion, and mind (or soul) is matter. All things, moreover, are characterized by the same fundamental tendency, namely, the tendency to persist in their present condition, whether of motion or of rest. Hobbes did not deny the existence of God as first cause, but he maintained that man " cannot have any idea of him." Hobbes' main influence lay in the realm of moral and political philosophy, and even there it showed itself chiefly by provoking opposition.

Spinoza (1632–1677) was the first modern to give complete expression to the naturalism and rationalism with which modern thought reacted against the supernaturalism and dogmatism of the Middle Ages. He vindicated the autonomy of reason against every kind of authority, insisting that even the Scriptures must be submitted to the same kind of examination as any other historical documents. Now the characteristic function of reason is to discover the systematic connections between things. It is therefore opposed to any supernatural incursions which tend to break up the systematic interconnections between natural events. Hence we find in Spinoza rationalism and naturalism going hand in hand. But his naturalism is very different from the naturalism of Hobbes. In Nature, as he conceives it, there is room for the mental (or spiritual) as well as the material, and for the divine as well as the human and subhuman. In fact, for Spinoza Nature (or the cosmic system) and God are the same. The All is God, and God is All. Let us glance at the ground and structure of Spinoza's pantheism.

Every finite object or event is dependent on innumerable others, which ramify in all directions, and are each of them similarly dependent on innumerable others. But a world consisting solely of such contingent objects and events would be unintelligible. There must be some self-dependent reality (or " Substance ") which sustains all the dependent things and events. But this self-existing " Substance " need not be sought in an external creator ; the cosmic system (or Nature) in its entirety may satisfy this quest for God. Scientifically, this view avoids the unnecessary multiplication of entities, and the problem of creation from nothing. Nature or God is thus conceived as all-comprehensive, infinite or perfect, so that there is nothing outside the cosmic system, nothing supernatural. Nature, moreover, is not static but dynamic, exercising all existing forms of energy. Each ultimate kind of energy is described as an Attribute of God. Man only knows of two such ultimate attributes, namely, extension and thought, that is, physical energy and mind energy. But there may be an infinity of others. All material bodies and physical events are " modes " (that is, modifications or states) of the attribute extension, and all minds and mental experiences are modes of the attribute thought. The apparent interaction between body and mind arises from their being concomitant modes of the constitutive attributes of the one ultimate reality. The various finite modes are not illusions, but real while they last ; and even when they pass away they do not utterly disappear, for the One remains in which the many change and change again. Spinoza is so opposed to anthropomorphism and its abuses that he declines to describe God as a Person ; but only because He is so much *more* than we can understand by a person. God, as Spinoza conceived Him, is super-personal, but not less worthy of love for that, as is clear from Spinoza's life and character. In fact Spinoza's philosophy culminates in " the intellectual love of God," which is the fruit of that highest intuition to which man attains when, after an adequate discipline of intelligence and character, he arrives at a synoptic vision of the One and All.

Leibniz (1646–1716) formulated a philosophy of Monadism. He held that so-called material objects, and even space, have no objective reality, but are mere appearances within the experiences of minds. Minds (souls or spirits) are the only realities. They are of all degrees of development, some having but a very low kind of consciousness or sub-consciousness, a kind of chronic somnolence, others are in a somewhat higher dream-state, yet others are wide awake and have clear thoughts, while God ("the monad of monads") enjoys the most intense and most active consciousness. The monads are infinite in number and infinite in gradation, no two monads being exactly alike. Moreover, each monad is self-contained and is not affected by the others, except only by God who has created them by a kind of emanation. The appearance of interaction between different monads is due to a "pre-established harmony." God, in other words, has so made them that they all act in harmony. It is as if He had set a number of clocks to keep time together. The whole outlook bears the impress of supernaturalism. Yet in dealing with so-called physical phenomena Leibniz sought mechanical explanations, though he tried to reinstate also teleological explanations by treating mechanism as an instrument of teleology. The ultimate motive which prompted this idealistic monadology was the anxiety to justify the belief in the ultimate reality and permanence of individual souls.

Locke (1632–1704) attempted to divert philosophy from ambitious cosmic speculations to the study of the nature and limits of human knowledge. He was wont to discuss religious problems with certain friends of his, but the discussions seemed fruitless. It then occurred to him "that before we set ourselves upon inquiries of that nature, it was necessary to examine our own abilities, and see what objects our understandings were or were not fitted to deal with." For by "extending their inquiries beyond their capacities" people "raise questions and multiply disputes, which . . . only . . . increase their doubts." The main results of his examination of the human understanding may be briefly summarized as follows. Our understanding is dependent on sensations. It can reflect on these, and combine them into more complex wholes, but it cannot add to them. Now sensations are at best only appearances or copies of the primary qualities of things (extension, shape, solidity, number, motion). Sensations of secondary qualities (colour, smell, sound, taste) are merely subjective effects produced in us by primary qualities, and are not copies of anything objective. Our ideas of substances (bodies and souls) are vague, and cannot be justified by sense-experience. Hence it is impossible to say whether the soul is a spiritual substance, or a material substance endowed with the capacity to think. In fact, man does not know the "real essence" of anything, and is strictly limited to his experience. Each man can only be sure of his own existence, by intuition, and of the existence of God as the cause of man's existence. So, three years after the publication of Newton's *Principia*, Locke's *Essay* (1690) considered "a science of physical bodies as out of our reach" (beyond merely empirical limits), while regarding mathematics and ethics as real sciences because they are only concerned with ideas.

The five seventeenth-century systems of philosophy outlined above may be said to have provided the broad foundations for all, or nearly all, the philosophies which appeared during the two centuries and more that have elapsed since then.

Eighteenth Century Philosophy

Berkeley (1685–1753) formulated an idealistic philosophy to counter the materialistic tendencies of his age. The progress of mechanics in the seventeenth century had been so striking that thinkers naturally attempted to extend mechanistic modes of explanation (that is, explanations in terms of matter and motion) in all directions. The materialistic philosophy of Hobbes was a supreme example of this tendency; and Hobbes did not stand alone. Good Bishop Berkeley tried to refute the whole movement by disproving the reality of matter, in favour of spirits and ideas. Taking Locke's *Essay* for his text, Berkeley maintained that our ideas or sensations of primary qualities, as well as those of secondary qualities, cannot be " copies " of anything objective, but are mental experiences, and nothing else. Ideas can only resemble ideas, not material objects or their qualities. It is therefore unwarranted and superfluous to assume the existence of material bodies at all. Our ideas themselves, and not the alleged material things beyond them, are the real objects of knowledge. " All the choir of heaven and furniture of earth . . . have not any substance without the mind; . . . their *being* is to be perceived or known." When they are not perceived by man, then " they must either have no existence at all, or else subsist in the mind of some Eternal Spirit." But how is it that material bodies appear to produce certain effects with such regularity, if they are only ideas ? Berkeley explains this as the result of " an arbitrary connection instituted by the Author of Nature " between the corresponding ideas. The only realities, then, are God, other spirits or souls created by Him, and the various ideas or experiences which He has ordained to be apprehended in certain regular sequences.

Hume (1711–1776) maintained that the line of argument pursued by Locke and Berkeley ends in scepticism. Berkeley had argued that, on Locke's own showing, there is not enough evidence for assuming the reality of material substances or material causation, though he insisted on the reality of spirits (or souls) and spiritual agency. Hume maintained that Berkeley's arguments against the former were just as valid against the latter. He repudiated Berkeley's contention that each man has an intuition of his own soul or self. " For my part when I enter most intimately into what I call *myself*, I always stumble on some particular perception or other. . . . I never catch *myself*." All that seems to be real is a miscellaneous multitude of disconnected impressions and ideas, to which habitual association gives the appearance of causally connected events, while our mistaking of similar impressions for identical ones gives them the appearance of enduring substances. The flux of changing experiences is all that is sure. Even mathematics is not certain. The most that can be claimed for anything is probability. Hume himself found his conclusions baffling, but he pleaded " the privilege of the sceptic."

Kant (1724–1804) attempted to bridge the chasm between ideas and the external world in which Hume's philosophy ended. This divorce between the subjective and the objective was the natural result of the line of thought pursued by Descartes, Leibniz, Locke, and Berkeley. But Kant had too much respect for the achievements of science to dismiss their claims in the manner proposed by the scepticism of Hume. And his defence of the sciences took the form of a comparatively new method, the so-called " transcendental," which was a striking development of the older doctrines of " common notions," " eternal truths," and " innate ideas." Kant conceived the objects of knowledge as the joint production of sense-materials, which are independent of the mind, and of certain forms and relations which the mind contributes. These forms of intuition (space and time) and relations or categories of thought (substance and attribute, cause and effect, etc.) are *a priori* or " transcendental " in the sense that they are not learned from experience, since experience itself would be impossible without them. On the other hand, the sense-material is *a posteriori*, that is, only given in experience, though it is given not as it is " in itself " but only as transformed by the *a priori* forms and categories. Human knowledge does not extend to " things-in-themselves " (or noumena) but only to their appearances (phenomena) as moulded in the way just indicated. The application of the *a priori* forms and categories to whatever falls within human experience is legitimate and, in fact, inevitable. But they must not be applied to whatever transcends such experience. God and future life, for instance, are beyond human experience, and consequently cannot be argued about at all—they can be neither proved nor disproved. But they may be *believed in* as a matter of *faith* based, not on theoretical, but *on practical grounds*. And it is on such practical considerations that Kant based the belief in the existence of God, freewill, and immortality. These are postulated by the unconditional claims of morality (the " categorical imperative "), just as the reality of an objective world of some sort is postulated by the theoretical claims of science.

Materialism

In opposition to the idealism of Berkeley his countryman Toland (1670–1721) advocated the materialism of Hobbes. He insisted that matter was not the inert thing that Descartes had represented it to be, but an *active* substance or *force*. Matter is force, motion, life, and mind is one of its functions. Thought is a function of the brain, just as taste is a function of the tongue. *Hartley* (1704–1757) likewise embraced a materialistic philosophy, and attempted to reduce psychology to physiology. Priestley (1733–1804) was perhaps the most important British materialist of the eighteenth century. He enumerated many plausible reasons in support of materialism (some of them actually drawn from the Bible), and argued that only on the assumption of God's materiality can the Christian dogma of His omnipresence be maintained. In France materialism was stimulated unintentionally by Descartes. Descartes was a dualist and theist, in fact an orthodox Catholic, but his view that the lower animals are mere automata, and his account of how all the limbs can be set in motion by sense stimuli without the intervention of the soul, led La Mettrie and others to dispense with souls altogether, and to explain all things mechanically. La Mettrie (1709–1751) insisted that man is not a privileged being, and that there are no ultimate differences between plants, animals, and men. They are all subject to the same laws, and represent different stages of one evolutionary process. Other French materialists were Diderot (1731–1784), Helvetius (1715–1771), D'Alembert (1717–1783), D'Holbach (1723–1789) and Cabanis (1757–1808). To Cabanis are due some of the most familiar dicta of materialism. Body and soul are the same thing. Man is just a bundle of nerves. The brain secretes thought just as the liver secretes bile. All things, even the so-called mental and moral phenomena, follow from the laws and properties of matter. Phrenology was naturally an offspring of this kind of materialism.

Eighteenth Century Science

The progress of astronomy after Newton proceeded along two main lines, observational and mathematical. The most important work in observational astronomy in the eighteenth century is associated with the name of Herschel (1738–1822). In 1781 he discovered a new planet (Uranus) with two satellites beyond Saturn. Even more significant in some way was his discovery of 800 double stars, that is, pairs of stars revolving about each other according to the law of gravitation. This showed that the law held beyond the solar system. He also catalogued 2,000 nebulæ, which he conceived to represent different stages in the development of planetary systems. Moreover, by comparing the distribution of stars in the heavens he concluded that our star-system is approximately lens-shaped. Mention must also be made of Halley's observation of comets and his determination of the periodicity of two of them. Equally important was his discovery that certain fixed stars were changing their relative positions, and so were not really " fixed." Mathematical astronomy was mainly concerned with the development of the implications of the laws of gravitation and motion. The chief problem was how to determine the relative motions of three or more mutually attracting bodies. Euler, D'Alembert, Clairaut, and Lagrange worked out this problem with special reference to lunar and planetary theory, and the results of their labours were systematized and rounded off by Laplace in his *Celestial Mechanics* (1799). Laplace showed that the solar system is stable, the mutual interferences of its parts never exceeding certain limits. Laplace also made the first scientific attempt to explain the origin of the solar system. According to his Nebular Hypothesis (1796) the planets have condensed from rings thrown off by a rotating and contracting mass of glowing gas. This hypothesis had to be abandoned a century later, but is still accepted as a true account of the condensation of single stars out of a nebula.

In physics the eighteenth century made important contributions to the study of heat, sound, magnetism and electricity. Black's experimental work in heat led him to the discovery of specific heat and of latent heat, the latter of which was an important factor in Watt's discoveries in steam engineering. Rumford's experiments succeeded in establishing the hypothesis that heat is a mode of motion, not a kind of stuff like phlogiston with its ambiguous " levity." In the study of sound Hawksbee, in 1705, first proved experimentally the dependence of sound on air, while Chladni (1756–1827) brought the study nearly to its present level. In the study of magnetism and electricity eighteenth century scientists made amends for the comparative neglect into which it had fallen since the days of Gilbert. A beginning was made by Hawksbee and the work was carried on by numerous investigators including Franklin, who established the electrical character of lightning, and Galvani and Volta, whose names have become household words through the " galvanic " battery, " galvanism," the " voltaic pile " and " voltage," etc.

In chemistry the eighteenth century is chiefly noteworthy for the first systematisation of the science, for a number of positive discoveries, and the disproof of several long-established errors. The century commenced rather unpromisingly with the phlogiston theory of Stahl (1660–1734). This was a glorified form of the old belief that in combustion a special kind of fire-matter (phlogiston) was given off. Thus, *e.g.*, when a metal was changed into a calx by heating, this was taken to show that the original metal consisted of the calx and the phlogiston, and that the latter was given off during the combustion. This hypothesis helped to bring some order into the chaos of many chemical details, but came into conflict with others. For instance, it had been observed already by an Arab chemist of the eleventh century that when a metal is calcined in the air it gains in weight. The supporters of the phlogiston theory met the case by saying that the phlogiston has levity instead of gravity, buoyancy instead of weight, and so its combination with the calx of a metal makes the metal lighter than is the calx by itself. Several discoveries, however, soon helped to disprove this old fancy (originally based on the obvious upward tendency of flame), though the discoverers did not always see the significance of them in this connection. Black (1728–1799) showed that when chalk is changed into quicklime it gives off a gas different from air. This led to the search for other gases. Priestley (1733–1804) and Scheele (1742–1786) discovered independently the gas subsequently called oxygen. The gas was obtained by heating calx of mercury. This discovery led Lavoisier (1743–1794) to the correct interpretation of calcination. He showed that in combustion the combustible matter combines with oxygen, which is one of the gases constituting air. Thus the calx of, say, a metal contains more than the metal did, and that is why it is heavier. The phlogiston theory was therefore disproved. Incidentally, it was also shown that air is not an element. Water too was shown to be a compound when Cavendish (1731–1810) discovered hydrogen and, by synthesizing it with oxygen, produced water. The principal honours of eighteenth-century chemistry go to Lavoisier, who extended and systematized all the good chemical work done up to his time. He gave vogue to Boyle's stricter use of the term " element," introduced a more scientific system of chemical names, set an example of the use of chemical equations, and virtually formulated the principle of conservation of matter when he postulated that " in every operation there exists an equal quantity of matter before and after the operation." The execution of Lavoisier by the leaders of the French Revolution was an irreparable loss to chemistry, and a warning that fanaticism is not the monopoly of religion.

The biology of the eighteenth century was mainly preparatory for the century of evolution. But a great deal was attempted and something was accomplished in descriptive biology, systematic biology, and in more speculative biology. In his *Natural History* Buffon (1707–1788) gave the most elaborate account known up to his time of the life, habits, geographical distribution of animals, and of the climatic and other conditions in which they lived. This work did much to make the study of natural history popular. Scientifically Linnæus (1707–1778) was more important than Buffon, for he did much to systematize biology, by introducing an improved classification of plants and an improved system of names, which are still useful for purposes of identification. The Linnæan system of classification is known as the Sex System. It was still rather artificial, but, in conjunction with the work of Jussieu and others, it prepared the ground for a natural classification based on kinship. The ancient belief in spontaneous generation of animals was still very common, but the experiments of Spallanzani (1729–1799) helped to discredit it, and moreover set an example of accurate experimentation in connection with this kind of problem. Of special importance to the future of biology was the introduction of the comparative method, which led gradually to the accumulation of the kind of evidence on which the theory of evolution was eventually based. In this connection Buffon's *Natural History* and Goethe's *Metamorphosis of Plants* may be specially credited with the popularization of the general idea of evolution. Intimately connected with the evolutionary ideas in biology was the new interest that was directed to the study of fossils, and of geology in general. In his *Theory of the Earth* (1788), Hutton (1726–1797) laid the foundations of scientific geology. In the sphere of applied biology the event of outstanding importance was the discovery of vaccination by Jenner (1749–1823), who thereby laid the foundations of preventive medicine.

Nineteenth Century Philosophy

Idealism. Although Kant himself had uttered a warning against speculation about the thing-in-itself, or Absolute, yet his writings contained suggestions which stimulated a number of thinkers to devote themselves just to that " forbidden fruit." The best known of these thinkers were Fichte, Schelling, and Hegel.

Fichte (1765–1814) maintained that even the thing-in-itself is the product of the mind. The whole of experience, not its form only, is generated by the " absolute self," in which individual minds participate. The " absolute self " divides itself into a knowing self and a known object, because the moral growth of the self needs objects as obstacles to be surmounted by moral endeavour. For similar reasons the absolute self must divide into many selves, otherwise there would be no opportunity for the exercise of mutual duties. But the many selves are all expressions of one moral order, which is the absolute self or God.

Schelling (1775–1854) attempted to rescue the reality of the physical world from the idealist tendency to explain it away as mere appearances or ideas. He regarded the beauty of the material world as a sufficient justification of its reality, and he conceived it to be an expression of the

Absolute just as mind is. This led to the view that the Absolute is neither mind nor matter though it expresses itself in both. Thus the Absolute reverted to the position of an unknown thing-in-itself.

Hegel (1770–1831) rejected the idea of an unknown thing-in-itself or Absolute. Mind and physical Nature, he insisted, *are* the Absolute, not merely appearances or expressions of an otherwise unknown Absolute. Moreover, mind and matter are not two distinct realities but integral components of one process of self-revelation of the Absolute. Mind needs an objective world on which to exercise itself; but this objective world is itself mental. " The real is rational, and the rational is real." Moreover, the development of reality proceeds like a dialectic. Some thought occurs (thesis). It is opposed by another thought (antithesis), which also proves to be inadequate. But a third harmonizes what is true in the first two (synthesis). Thus, for instance, " becoming " is such a synthesis of " being " and " non-being." The whole world is composed of such syntheses. And Hegel's conception of the world-process as a rational dialectic gave a new impetus to the study of history, which came to be regarded as the unfolding of a divine drama. Unfortunately Hegel's philosophy lent itself to opposite applications. Young revolutionaries took for their motto one half of Hegel's dictum, namely, " the rational is real " or is bound to become real; conservatives and reactionaries adopted the other half of the dictum, namely, " the real is rational," what is, is right.

Fechner (1801–1887) regarded the universe as a society of souls, and God as the supreme all-embracing Soul. Inwardly all souls are mental, but outwardly they appear to each other as material bodies. And just as smaller bodies are included in larger bodies, and all bodies are included in physical nature, so some souls are included in others, and the soul of God embraces all other souls. Life and consciousness do not evolve out of the lifeless and the unconscious, rather these are degradations of the former by a kind of secondary automatism.

Lotze (1817–1881) propounded an idealistic pantheism. Ultimate reality is mental Substance. Material phenomena are appearances produced by souls or spiritual monads (as Leibniz had maintained), but those monads Lotze (in opposition to Leibniz) regarded, not as independent substances, but as modes or states of God, who is the sole and infinite Substance. Mechanistic phenomena are appearances resulting from the uniform laws with which God carries out these immanent activities, which are nevertheless directed to divine ends.

Voluntarism. Whereas the Idealists identified ultimate reality with thought or reason, other philosophers identified it with will. Already Descartes had given primacy to the will, and Kant had given some encouragement to this tendency by treating the highest truths as moral or practical postulates. The chief voluntarists were Schopenhauer, Hartmann, Nietzsche, and Wundt.

Schopenhauer (1788–1860) identified ultimate reality with an irrational " will-in-general," or universal will. There are no individual things or wills. Individuality is mere illusion. For it depends on differences of time and place, which Kant had shown to be merely forms in which the things-in-itself appears, not constituents of it. Moreover, the will is essentially evil, and can never be satisfied. Life is a welter of unsatisfied cravings. The best course is to see through the illusoriness of individuality and the futility of the quest for satisfaction, and look upon life as if it were a work of art. Thus Schopenhauer's pessimism ended in a kind of Buddhist self-renunciation.

Hartmann (1842–1906) developed the voluntarism and pessimism of Schopenhauer into a "philosophy of the Unconscious." Whereas Schopenhauer treated representation (or cognition) as a mere instrument of will, Hartmann puts them both on the same level. Together they constitute the "unconscious" Absolute, which gradually differentiates into the two, becomes conscious, and realizes the tragedy of the will to live. By setting the two (will and representation) against each other (for instance, by devotion to such intellectual pursuits as those of the sciences), they may both be annihilated, and the evils of existence may be brought to an end. In this way mankind may redeem its "unconscious" God.

Nietzsche (1844–1900) attempted a synthesis of Kant, Schopenhauer, and Darwin. The inference he drew from Kant's theory of knowledge was that there is no such thing as knowledge, only fiction. Truth is not discovered, but created or invented. Beliefs, indeed, are not all alike. But the proper distinction is between those which are *useful* and those which are *useless*, not between those which are *true* and those which are *false*. Like Schopenhauer, Nietzsche identified ultimate reality with will, but he characterized this will as a "will to power," not merely as a "will to live." "The love of power is the dæmon of mankind." Like Schopenhauer, Nietzsche saw the world in sombre hues, but, instead of preaching an ideal of Buddhist acquiescence, he urged the gospel of energetic and dangerous living. Life is a kind of Greek drama in which the hero shows his mettle. The "struggle for existence" has the merit of bringing the superior men to the top. And Nietzsche looked forward to the coming of "supermen" as the result of the "survival of the fittest." The "superman" will surpass the existing human type as much as present-day man surpasses the ape.

Wundt (1832–1921) also identified basic reality with will, but a will which is never entirely divorced from feeling and ideas. There are two grades of will, namely, impulsive and voluntary (or deliberate) will. Even impulsive will needs feeling directed toward an end, and therefore an idea, but not that conscious adoption of a motive which characterizes voluntary will. As all organisms have impulsive will, organic evolution is teleological, mechanism being invented by it as an instrument for its own ends. Wundt identified will with activity of every kind. Hence, not only attention but even thinking is identified with will. This led to William James's doctrine of the "will to believe." Like Kant, Wundt restricted human knowledge to experience. In so far as reason attempts to transcend experience, it can only posit "ideals of faith." God is such an ideal conceived as the world-will.

Materialism. The middle of the nineteenth century witnessed a revival of materialism, especially in scientific circles. This was largely a kind of reaction against idealism and its rash incursions into the domain of science. The generation which witnessed the physical experiments of Mayer, Joule, and Helmholtz (who established the principle of conservation of energy), the chemical researches of Liebig, and the microscopic investigations of Schwann (who showed the cell to be the unit of animal as well as of plant organisms) and of Schleiden (who rejected vitalism) had no patience with the romantic fancies of idealists, and their rejection of the reality of matter. Moreover, advances made in the technical arts, and the resulting improvements in industrial and economic conditions, helped to encourage a special interest in things material. So contact was renewed with the materialism of the preceding centuries. Moleschott (1822–1893) described the whole cycle of life in terms of matter and energy. "No sulphur, no thought." Vogt (1817–1895) added to this dictum the one of Cabanis, that the brain secretes thought as the liver secretes bile. Büchner (1824–1899) was probably the most important of this group of thinkers. His book *Force and Matter* served for a long time as the armoury of materialism. He identified all force with motion, and regarded everything as produced by matter and motion. But, though he distinguished between matter and motion, he insisted that they are inseparable. Rejecting vitalism, he regarded life as generated spontaneously out of matter under certain conditions, and that mental process is only "a radiation through the cells of the grey substance of the brain of a motion set up by external stimuli." Czolbe (1819–1873) condemned everything super-sensible as "transcendental nonsense." But he did not think that Büchner's "force and matter" would explain everything. It was necessary to assume organic forces, mental elements, etc., as well as material atoms and motion. And he regarded the natural system as an harmonious and purposive whole. It is worth noting that all these materialist scientists and philosophers were filled with enthusiasm for humanity and human progress.

Positivism and Evolutionism. The whole trend of modern science was away from supernaturalism, and even those who were not satisfied with the philosophy of materialism had recourse to a philosophy which refrained from supernaturalism, and conceived the world as a naturalistic system of law and order. This usually entailed moderation in metaphysical speculation or a certain amount of agnosticism. Comte, Mill and Spencer are the chief representatives of this movement, which was influenced partly by the empiricism of Locke and partly by the critical philosophy of Kant.

Comte (1798–1857) was the founder of what is known as Positivism. Like Kant he maintained that human knowledge is limited to phenomena, things-in-themselves being beyond our ken. It is therefore best for men to concentrate their efforts on the advancement of scientific knowledge and the amelioration of social conditions. Philosophers should relinquish the quest of what is unknowable (the Absolute, etc.), and take up the task of co-ordinating and systematizing the methods and results of the sciences. And religious devotion should be diverted from the fruitless service of an unknown God to the service of Humanity. In this way religion, instead of being a source of sectarianism and mutual discord, will become a means of human solidarity. Such Catholicism without supernaturalism could only make very slow progress, as most people hanker after the supernatural. Mill (1806–1873) was also a positivist, though he was influenced by Locke rather than by Kant. His logic, his utilitarian ethics and his political economy were all worked out on positivist or empirical lines.

Spencer (1820–1903) likewise confined human knowledge to phenomena, but admitted an " unknown " ground of the phenomenal world. His fame rests mainly on his ambitious attempt to bring all things into one evolutionary scheme. The world, according to Spencer, began as an homogeneous something which may be called force or matter and motion, but whose inner nature is unknown. By its gradual differentiation there evolved first the heavenly bodies (more or less according to the nebular hypothesis of Laplace). The organic world then evolved out of the inorganic (on the lines of Lamarckian and Darwinian biology). Differentiation of structure and function in living bodies followed in due course, also division of labour in industry, and so forth. The total amount of energy in the universe remains always the same, it is only distributed variously. The evolutionary process was conceived by Spencer and others on mechanistic lines. Bergson's " creative evolution " and Lloyd Morgan's " emergent evolution " were intended to correct this mechanistic tendency, and to vindicate the spontaneity and originality of cosmic processes.

Nineteenth Century Science

Astronomy continued its advance along the lines followed in the preceding century, but with the assistance of new and powerful auxiliaries in photography and spectroscopy. Refinements in lunar and planetary theory led to the discovery of the planet Neptune in 1846. The existence and the position of the new planet had been inferred independently by Adams and Leverrier from a mathematical analysis of the irregularities observed in the movement of Uranus, and so afforded a striking confirmation of the principles of Newtonian astronomy. In observational astronomy Bessel's detection of stellar parallax, in 1838, was an event of great significance. The failure to observe parallax (that is, a change in the apparent position of fixed stars corresponding to changes in the position of the earth in its orbit) had been one of the chief objections to the heliocentric theory of Aristarchus and Copernicus. In the eighteenth century Bradley sought parallax, but only observed the aberration of light (which results from the observer's motion athwart the paths along which stellar rays reach him). Bessel's observation of parallax was a direct confirmation of the heliocentric theory. The nineteenth century also witnessed a much more accurate determination of the sun's distance from the earth than had been possible before. But the most remarkable novelty was the spectroscopic discovery of the chemical composition of the celestial bodies. The method used was briefly as follows. Each chemical element, when incandescent, emits a light which resolves by dispersion into a characteristic spectrum ; and whenever this spectrum is detected in the light from a star, the presence of this element may be reasonably inferred. Moreover, the displacement of the spectral lines of a star proves that the star is in motion relatively to the observer. In this kind of way the combination of photography with spectroscopy has yielded much information about the velocities, temperatures, and evolutionary stages of stars; and in some cases even their distances and masses can be inferred.

In the realm of pure mathematics the discovery of most general interest was that of non-Euclidean geometry. The principal workers in this field were Gauss, Bolyai, Lobatchevsky, and Riemann. It was shown that Euclid's axioms of geometry were not the only possible ones, that sets of axioms can be formulated arbitrarily, and self-consistent geometries based on them; also that the space assumed in Euclidean geometry is only a special case of a more general type. Non-Euclidean geometries first assumed physical significance when it was found that the space-time continuum required by Einstein's theory of gravitation is non-Euclidean.

In physics Rumford's ideas about heat were developed by Joule, who established the equivalence between the heat produced and the work or chemical energy expended in producing it. Helmholtz extended the principle of the mutual convertibility and conservation of heat and energy to the whole realm of nature, and in this form it became known as the First Law of Thermodynamics. Meanwhile Carnot had discovered that the working of a heat-engine involves the transfer of heat from a hot source to a colder sink. The ideas of Carnot had very important results. In the first place they led Lord Kelvin to the fruitful conception of an absolute scale of temperature. In the second place, in conjunction with Joule's discovery, they led Clausius and Lord Kelvin to the formulation of the Second Law of Thermodynamics, namely, that heat cannot of itself pass from a colder to a hotter body. As every transfer of heat from a hotter to a colder body tends to equalize the temperature of the universe, it was inferred that the universe is tending to a state of uniform temperature, in which no heat will be available for work. Since this tendency is irreversible, it has been described by Eddington as the only physical criterion for distinguishing the future from the past.

In the study of light, the nineteenth century opened with experiments by Young and Fresnel which favoured the undulatory theory formulated by Huygens. Fresnel, however, found it necessary to assume that light-waves are transverse, not longitudinal. This, in turn, involved the attribution of incompatible properties to the æther. But the work of Oersted, Ampère, Neumann, and Faraday in connection with electromagnetism was preparing the way for Maxwell's electromagnetic theory of light. The experimental results obtained by these physicists convinced Maxwell that electromagnetic charges do not act across empty space, but through a medium; and he succeeded in formulating equations expressing the fundamental electromagnetic laws in terms of the electrical and magnetic properties of any given medium. For insulating media (including most transparent media) these equations had a form characteristic of transverse wave-motion. Such electromagnetic waves were unknown then, but the equations showed that if they existed they would have a velocity nearly equal to that of light, would be transverse, and subject to reflection, refraction, and double refraction—just like light.

Maxwell accordingly suggested that light-waves may be electromagnetic waves of comparatively short wave-length. In course of time Hertz showed experimentally that such electromagnetic waves exist, and that they behave like light-waves. The unification of the two kinds of waves and of their two media was a great simplification, and prepared the way for a still greater simplification, namely, Einstein's provisional unification of the phenomena of the electromagnetic and the gravitational fields as manifestations of the same structure of space. The upholders of the older mechanistic ideas are not quite reconciled to these newer views. The unitary electric charges which have to be assumed in connection with Maxwell's electromagnetic fields are regarded by them as corpuscles rather than as wave-groups, and as favouring a quasi-Newtonian hypothesis of light as consisting of corpuscles having associated wave-trains.

The discoveries of Galvani and Volta in current electricity were fully developed in the nineteenth century. The magnetic property of the current was discovered by Oersted in 1820, and its mathematical laws were investigated by Ampère, Faraday, Neumann, and Maxwell. Radio-telegraphy and the dynamo were the practical fruits of these researches. The chief quantitative laws of the electric circuit were determined by Ohm, Joule, and Weber. What is specially interesting, however, is the important rôle which electromagnetic theory played, and is still playing, outside its special domain. This has already been noted in connection with the theories of light described above. Something similar will be observed in connection with chemistry. For it was soon discovered that electric current has chemical properties which help to analyse chemical compounds into their elements. In this way Davy discovered a number of new metals. Faraday ascertained the quantitative laws governing electrolytic decomposition. He also suggested a theory of electrolysis, which was developed by Clausius and Arrhenius, to the effect that a certain percentage of the molecules of the dissolved salt are dissociated, by the mere process of solution, into oppositely charged particles which the subsequent application of an electric field impels in opposite directions. At the electrodes they lose their charges and so maintain the flow of current.

Chemistry at the beginning of the nineteenth century was mainly concerned with the exploitation of the atomic theory in the service of the special problems of chemical science. A first attempt in this direction had already been made in 1789 by W. Higgins, but it made no impression. A real advance was first made by Dalton (1766–1844) early in the nineteenth century. He held that each kind of elementary substance consists of a special kind of atoms, that each kind of atom has a characteristic weight, and that chemical combination takes place always between simple numbers of atoms. Assuming that in a combination of two elements there is one atom of each for every atom of the other, the relative combining proportions by weight should give the relative weights of the two kinds of atoms. Next, taking the atomic weight of hydrogen as the unit, he drew up a table of the atomic weights of the elements known in his day. His assumption was unwarranted, but his main theory served as a basis for the first quantitative laws formulated about that time—the laws of definite, multiple, and reciprocal proportions. In 1809 Gay-Lussac showed that gases reacted with each other in simple proportion by volume, and in 1811 Avogadro distinguished between molecules (that is, clusters of atoms) and (single) atoms, and postulated the existence of molecules in elementary gases. On combination one molecule might break up into two or more atoms. From all this it was deduced that the density of a gas is proportional to the weight of its molecules. Here was a means of surmounting some of Dalton's difficulties. But this line of research was not pursued further until Cannizzaro took it up again in 1858. In the interval Berzelius was busy determining atomic weights. But atomic weights were neglected in favour of the " equivalents " introduced by Wollaston in 1814, especially when Faraday discovered the Law of Electro-Chemical Equivalents in 1834. The use of a variety of chemical units caused much confusion until Cannizzaro helped to introduce some uniformity.

One of the most notable triumphs in nineteenth-century chemistry was achieved in 1828, when Wohler prepared for the first time an organic substance from inorganic materials. This, coupled with Berzelius' discovery, in 1814, that organic substances obey the ordinary laws of chemical combination, helped to banish the mystifying " vital force " which had been assumed to produce organic substances from carbon, hydrogen, oxygen, nitrogen, and phosphorus. Another notable achievement of nineteenth-century chemistry was Mendeléeff's discovery of the Periodic Table of Elements. Developing the suggestions of other chemists (notably L. Meyer and Newlands) Mendeléeff showed that the elements, when arranged in the order of their atomic weights, fall into series showing a periodicity of properties. By means of this periodic table he predicted the atomic weights and physical properties of various unknown elements which were subsequently discovered. Subsequent research by Moseley showed that the periodic table could be much improved by substituting an arrangement according to atomic numbers instead of atomic weights. Yet another noteworthy feature of the period is the tendency, started by Prout, to regard atoms of hydrogen as the ultimate constituents of all other kinds of atoms. This tendency to seek a common origin for all the different kinds of atoms, coupled with other influences, culminated subsequently in the conception that all kinds of atoms are composed of protons and electrons. For all practical purposes, of course, the differences between the elements retain their significance. And one simple way of indicating the progress of chemistry during the nineteenth century is to point out that whereas only some thirty elements were known at the beginning of the century, nearly eighty were known at the end of it.

Great as the scientific advances of the nineteenth century were in other directions, its most characteristic advance was in the realm of biology. It was essentially the age of evolution.

But before turning to the subject of evolution, a brief account must be given of certain other aspects of nineteenth-century biology, with special reference to the work of Pasteur on microbes or bacteria. The existence of minute rod-like organisms was first discovered by Leeuwenhoek about 1683. But the subject received little attention until the nineteenth century, when Schwann proved experimentally that putrefaction and alcoholic fermentation are the work of minute living organisms. In 1857 Pasteur took up the problem. He devoted himself to the closer study of these microscopic organisms, and founded the science of bacteriology. He showed that lactic, ammoniacal and other forms of fermentation also depend on bacteria. In 1873 he turned his attention to the study of contagion, thinking that it may be due to infection by specific germs. He showed in course of time that the silk-worm disease, anthrax or splenic fever in sheep and other animals, and chicken cholera are each the effect of the activity of a specific kind of germ. Later on the specific microbes of yet other diseases were discovered. One practical result of Pasteur's discoveries was the introduction by Lister of antiseptic surgery in 1887. This, coupled with the previous discovery of anæsthetics by Davy and others, made surgical operations much safer than they used to be. Moreover, following the example of Jenner's method of vaccination, Pasteur prepared various attenuated toxins, inoculation with which served to prevent, or to cure, such diseases as anthrax and hydrophobia, or rabies. Pasteur's work thus greatly advanced medical and surgical art as well as biological science. It also had important consequences in the field of practical agriculture. These biological discoveries were of the utmost practical importance, yet they were overshadowed by a mere theory—the Theory of Evolution. To this we must now turn.

In a vague kind of way the idea of evolution was an old idea, and familiar to many people by the end of the eighteenth century. But the nineteenth century witnessed the steady accumulation of vast masses of scientific evidence, which converted the idea of evolution from a mere speculation into a well-defined and well-supported scientific theory. Much of the evidence was actually prepared by scientists who did not accept the idea of evolution ; but this only gave additional value to their contributions. The main facts may be briefly outlined as follows. Cuvier laid the foundations of the science of palæontology by his studies of extinct vertebrates. Beginning with the examination of all known kinds of elephants, recent and fossil, he passed on to the study of all the extinct kinds of vertebrates accessible to him, and in 1821 published a very full and well-illustrated account of nearly a hundred of them. These descriptions suggested to some people theories of descent, say, of the modern horse from the extinct palæothere. But Cuvier cautiously asked for evidence of the existence of intermediate stages, and they were not known then, though they were discovered subsequently. In any case Cuvier's work made it possible to trace, however imperfectly, the descent of some modern ungulates (hoofed animals). Side by side with palæontology there arose the science of comparative embryology, which was founded by Baer. Starting from Pander's full account of the early stages in the development of a chick, Baer carried the work much further, and eventually formulated the principle that the development of an animal is a process of differentiation from the homogeneous to the heterogeneous. He compared it with Laplace's account of the development of the solar system from the nebula. In 1828 Baer appears to have inclined to the belief that the embryological evidence seemed to point to a common origin of the main types of animal life. About a year or two after Baer's death Schleiden and Schwann published their cell theory, that is, that all plants and animals are composed of cells. It was shown that the individual cells of a complex organism are generally alive, and sometimes remain alive after separation from the main body. In 1843 Barry showed that certain protozoa are single cells, which are capable not only of motion but also of self-support. In due course all multicellular organisms, their tissues, the fission of these tissues, etc., were all traced to the protozoa. The cell theory thus exercised a great unifying influence, even linking up to some extent plants with animals. Lyell's *Principles of Geology* (1830) refuted the view that sudden catastrophes had repeatedly interrupted the succession of living things on the face of the earth. In 1845 Darwin made evolutionary suggestions in the new edition of his *Journal*. And a few years later Hofmeister gave a well-authenticated example of evolutionary descent in his accounts of flowering plants and higher cryptogams (plants which are flowerless or in which fructification is concealed). In 1859 Darwin published his *Origin of Species*, setting out the main lines of evidence on which he based his theory of the evolution of species by natural selection. It had taken him twenty years or more to collect the data and to make the experiments in support of the theory which first gave to the biological sciences a principle of synthesis comparable, to some extent, with Newton's law of gravitation in the realm of the physical sciences.

Some of the chief ways in which Darwin's theory helped to unify and explain various biological phenomena may be indicated briefly as follows. (1) *Affinity*. From the sixteenth century onwards biologists felt that there were affinities between certain plants, and attempted to classify them according to their affinities, but could give no intelligible account of the nature of affinity. Darwin showed " that community of descent is the hidden bond which naturalists have been unconsciously seeking," " that the characters which naturalists consider as showing true affinity between any two or more species, are those which have been inherited from a common parent, all true classification being genealogical," the natural system of classes being founded on " descent with modification." The influence of Darwinism on botanical and zoological classifications has, of course, been enormous. (2) *Survivals*. The presence in embryo birds and mammals of such things as a series of paired clefts along the side of the neck, along which are arranged vessels as in gill-breathing vertebrates, can only be explained on the assumption that the ancestors of birds and mammals breathed by gills. Similarly with other survivals. (3) *Homologous structure*. Such limbs as the pectoral fin of the fish, the paddle of the whale, the wings of birds and bats, and the hand and arm of man perform such diverse actions as swimming, flying, grasping, yet they all show a common plan. And this is only intelligible on the assumption that the common plan of the fore-limbs of the different vertebrates has been inherited from a common ancestor. (4) *Fossil remains*. The vast collections of fossil remains gathered by palæontologists can be interpreted only in the light of Darwinism. In some cases, notably that of the horse, the series of stages in their evolution has been so fully worked out that even Cuvier would most probably have changed his views on the immutability of species. (5) *Naturalism*. By a careful selection of suitable cases, various naturalists had tried to base a natural theology on the evidence of adaptation in nature. The existence of predatory animals and noxious insects, etc., was either ignored or attributed to the devil. The doctrine of natural selection and the survival of the fittest helped to put an end to such supernaturalist speculations in biology, and thus brought the biological sciences within the naturalistic scheme of the physical sciences.

Largely through the influences of evolutionary biology, the same kind of naturalistic attitude has been introduced into such human and social sciences as psychology, anthropology, sociology, and economics. Religion itself is now studied on comparative and evolutionary lines.

ANTAGONISM BETWEEN SCIENCE, PHILOSOPHY AND THEOLOGY IN THE NINETEENTH CENTURY

Philosophically the significance of Darwinism lay in the fact that it helped to encourage the naturalistic or positivist tendencies of the age. For the conception of a struggle for existence and the survival of the fittest by natural selection seemed to do away with the need of employing the ideas of purpose and design in order to explain biological phenomena. It appeared to offer a purely mechanistic explanation in a region which was wont to be regarded as a stronghold of idealistic philosophers and defenders of the faith. Men of science, or at least many of them, not unnaturally bore a grudge against the more or less intolerant Churches and the philosophers who usually defended them. The middle decades of the nineteenth century witnessed remarkably strained relations between science, on the one hand, and philosophy and theology, on the other. This friction may have contributed to some extent to the exaggerated ideas which some men of science entertained about the possibility of explaining everything by means of matter and energy, or about the extent to which people could practise the art of self-denial in refraining from cosmic speculation and religious faith. Their hostility to Church dogmas and to idealistic philosophies probably did some good. It helped to encourage and intensify interest in man's earthly concerns, and in practical endeavours for the amelioration of the conditions under which the masses lived and toiled. It also helped the more intelligent members of the Churches to form more enlightened views of the world, and to adopt a more tolerant attitude towards those who belonged to other Churches or to none. In this work of general enlightenment philosophers took part, of course. For some of the philosophers were just as empirically minded, and as positivist or agnostic as the most combative men of science. But a very large percentage of philosophers were sufficiently identified with the philosophic defence of Church dogmas to rouse the antipathy of the fighting men of science. These strained relations between science, on the one hand, and philosophy and theology, on the other, may seem very strange in view of the next swing of the pendulum (which is dealt with in the Article on *Recent and Contemporary Philosophy*). But the mutual criticism during the period of hostility probably had no little share in bringing about that better mutual understanding which is the basis of those friendlier relations between them which now exist.

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THE IDEA OF GOD: AN INTRODUCTION TO THE PHILOSOPHY OF RELIGION

By

W. R. MATTHEWS

SYNOPSIS

The nature and aim of the philosophy of religion — Systematic thought on religion in ancient and modern times — In some sense, philosophy of religion a modern study — The relation of the philosophy of religion to general philosophy and its point of contact with theology — The chief problems to be discussed: (*a*) the nature of religion; (*b*) the ideas of God and the supernatural; (*c*) the real existence of God; (*d*) the theistic view of the universe and special problems arising from it, *e.g.* evil, creation, and revelation.

I The nature of religion a philosophical question which cannot be answered by psychology or sociology alone — Theories of religion: (*a*) Intellectualist: the merits and defects of this theory. (*b*) Moralist: merits and defects. (*c*) Romantic: merits and defects. Views of Schleiermacher and Otto — Positive statement of nature of religion — the tendencies of thought, will and emotion which are to be discerned in it. The basis of religious development. The relation of religion to other forms of spiritual life — " Anthropomorphism " in religion: higher and lower types — Reason and feeling in religion.

II The causes of the abandonment of all polytheistic forms of belief in the highest religion — Monotheism the only conception of the Divine which is compatible with the demands of reason and conscience — " Proofs " of the existence of God: their nature and value — The modern approach to the problem of " proof " — The three " rational " arguments — The Ontological argument stated — The vacillations of philosophy on the validity of this argument — The permanent value of the argument — The Cosmological argument stated — Criticisms and objections — The modern way of presenting the argument — The philosophy of nature and of history — The postulate of a transcendent Being required — The Teleological argument stated — The theory of evolution and its consequences for teleology — The Monotheistic hypothesis supported by " emergent " evolution — The Moral argument — Kant's influence in modern thought — Moral development and absolute obligation — The implications of the moral consciousness — The ultimate Good — The Beautiful : its relation with the Monotheistic creed — Cumulative character of argument for Theism — The Agnostic theory untenable as theory and contradictory as a practical attitude.

III " Religion without God " in recent thought — Positivism : its defects — " Religion of Evolution " — The imperfection of any theory of religion which takes evolution as ultimate — Professor Alexander and Mr. H. G. Wells criticized — The religion of evolution requires a doubtful assumption.

IV Problems of the Divine Nature — God and the Absolute — Divine Personality — The religious needs which are met by the belief — Reasons for affirming its truth — The *via eminentiæ* — The conception of Perfect Personality — Divergent views on the nature of Personality in God — Creation — The difference between Theism and Pantheism : Emanation and Creation — Immanence and Transcendence — Degrees of immanence — Meaning of transcendence — Divergent views in recent religious thought on the subject of transcendence — The Divine Attributes : the Holiness of God : Love in God — Omnipotence : different conceptions of the meaning of this attribute — The Problem of Evil : the kinds of evil — The theory that all evil is defect of being : that it is the element of " negativity " in progress — " The best possible world " — The Problem of Good — Suffering as an element in the Divine experience : different views on this subject discussed and a possible solution suggested.

V Immortality and the Life to come — Primitive and civilized conceptions of the future life — The religious aspect of belief in immortality — The problem of mind and body — Inherent and conditional immortality contrasted — The " conservation of values " — The metaphysical and moral " proofs " of immortality — The general nature of the future life : difficulty of attaining definite conceptions — The possibility of endless progress — Revelation — The primary source of revelation and the sacred writings of the higher religions — The necessity of the conception of revelation for living religion — Reason and Revelation — The evidence for revelation — The mediæval and modern views compared — Doctrine, Dogma and Revelation.

THE IDEA OF GOD: AN INTRODUCTION TO THE PHILOSOPHY OF RELIGION

The simplest and most comprehensive definition of the philosophy of religion is that it is systematic thought about religion. Plainly we may have a great deal of religion, and religion of a high order, without any conscious and critical reflection upon it. Here as elsewhere we live first and reflect, if at all, afterwards. Men had lived together in society for many generations before they began to ask what social life really is and what kind of society would be the best. In the same way, men had acted and felt as religious beings long before the question, What is religion and why do we worship? had presented itself to their minds. But the awakening of the divine curiosity which is the motive of philosophy led almost at once to the consideration of religion. The gods were among the first subjects of critical enquiry in the early days of Greek speculation ; and in the great period of ancient thought, that which embraces Socrates, Plato and Aristotle, ideas of the nature of the Divine were enunciated which have not ceased from that day until now profoundly to influence human life.

But in the strict sense the philosophy of religion may be described as a modern study. The wide extension of our knowledge of the history of the human race and the success of comparative and evolutionary studies of human beliefs and institutions have enabled us to see that religion is, in some sense, a whole. In spite of the very obvious differences which distinguished the actual religions of mankind from one another, including the utmost diversity of value, religion is something which is larger than any particular religion and raises problems which are prior to any which arise from the doctrines of any religious creed.

It need scarcely be said that the philosophy of religion is a part of general philosophy. The philosopher sets before himself the aim of interpreting the whole of experience ; and therefore he can scarcely decline the task of giving some account of that aspect of man's experience which we call religion. The subject, however, is so vast and the questions raised so fundamental that there is a legitimate place for the special study of the philosophy of religion, just as there is a need for a special study of the philosophy of morals.

It may be said that if the philosophy of religion means thinking about religion it is the same as theology. This is only partly true. Theology is certainly the application of reason and reflection to religious beliefs and the attempt to state them in a systematic manner ; and in this sense theology and the philosophy of religion are at one ; but theology generally means the doctrinal statement of some specific religion and hence is usually concerned with the intrepretation of some real or supposed revelation. The philosophy of religion does not begin with any authoritative statement of belief or standard of religious truth ; it is, in fact, part of its duty to consider critically the idea of revelation. Thus it may be said that the philosophy of religion is a necessary prelude to theology. Perhaps one of the weaknesses of modern English and American theology is that it has often been discussed without reference to philosophy.

This distinction which we have suggested between theology and the philosophy of religion is not the same as the distinction which has often been drawn between " natural " and " revealed " religion. By many of the Scholastic theologians of the Middle Ages, above all by Thomas Aquinas, it was held that some religious truths are attainable by the unaided exercise of the human reason, while others require the disclosure of supernatural revelation before they can be known. A similar view was common in England in the eighteenth century. But we do not mean to endorse this idea when we differentiate between the philosophy of religion and theology. Our differentiation depends on method and starting-point, and could be accepted by anyone who came to the conclusion that all religion was in fact revealed.

We can now state the chief problems with which the philosophy of religion must grapple. First in logical order comes the question of the nature of religion. But this inevitably leads on to a series of further problems. We can scarcely avoid raising the question of the value of religion as an attitude of mind. This again suggests the problem of the validity of some beliefs which are associated with much, if not with the whole of religion ; the ideas of God and of the supernatural in particular present themselves for critical enquiry. The question, Has religion any value ? is not the same as, Does God exist ? though they are closely related. It is possible to take the view, as indeed is done by some distinguished contemporary writers, that belief in God and the supernatural is not justified, but that religion is nevertheless an essential ingredient of worthy human life. The problem of the existence of God introduces us to the lines of thought which have been found satisfactory in the past by great thinkers as demonstrating His being, and requires us to estimate the present position of the arguments in the light of modern science and philosophy. Finally, there is a group of problems, each in itself of the greatest importance and complexity, which arise out of the religious or theistic view of the world : the problem of evil, the belief in immortality and the possibility and evidence of revelation. Perhaps we should add, as the final topic with which a philosophy of religion should deal, the nature of worship and its relation with man's highest good. Obviously these subjects are so vast, and the amount of reflection upon them both ancient and modern has been so extensive, that nothing but the barest sketch can be attempted here.

I

The problem of the nature of religion is considered from their special points of view by psychology, anthropology and sociology, and it has sometimes been held that the results of these sciences are a sufficient answer to the question, What is religion ? This, however, is not the case. We should need, at any rate, to co-ordinate and combine the verdicts of these sciences before we could regard our problem as solved. But

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further, there is a problem about religion which does not fall within the province of any positive science. When we ask, What is religion ? we most commonly have in mind something beyond the question, what religion has been, what beliefs it has comprised, what function it has fulfilled in social development : we have in view the problem of its significance and its future. We desire to know what place it holds in the spiritual life of man. In Aristotle's phrase, we are concerned with the real nature which cannot be separated from its ideal development, its *telos*. The situation may be illustrated again by a comparison with ethics. Psychology, anthropology and sociology have much to say about man's moral ideas and their evolution ; but at the end of their investigations we can still ask, But what *is* the good life, the life which is really good, and how is it distinguished from all other kinds of life ?

Philosophical theories of the nature of religion may be conveniently classified according to the element which they take to be fundamental ; and hence we obtain three divisions, corresponding to the three aspects of man's mental life, thought, will and feeling.

Intellectualist theories of religion find the essential element in it to be a kind of knowing : they regard every religion as, in essence, a view of the universe. Thus religion is closely akin to philosophy. Hegel, who held that philosophy was the supreme form of the Spirit, considered that religion was a permanent and independent activity of spirit, next in dignity and truth to philosophy. His modern Italian follower, Croce, however, holds that in this the great German thinker was mistaken, and believes that all religion is an imperfect philosophy, expressing a view of the world in images which are appropriate to art and not in concepts which are the true instruments of philosophy. In his opinion, therefore, religion is only a transient appearance and not a permanent and necessary form of the life of spirit. There is, of course, an element of truth in this view. Most religion is certainly associated with some belief or creed which claims to be knowledge about reality. But research does not support the contention that belief is the sole necessary ingredient of religion, for it would be easy to point to religious persons, both savage and civilized, in whom conscious belief or acceptance of creed is apparently absent. But the chief objection against the intellectualist theory is that religion plainly includes much more than belief about God or gods. It is an attitude of mind which, in most cases, embraces the impulse to worship and the feeling of a need for redemption.

The moralist theory of religion regards religion as primarily "practical" and concerned with the direction of the will. Most modern representatives of this view owe some kind of allegiance to Kant, who was the first to formulate the moral theory in a definite manner. According to his famous formula religion consists in " regarding all our duties as divine commands." The proposal, however, to take religion as equivalent to morality has great difficulties. Though we must admit that every religion has some effect on conduct and that, in the higher religions, this connexion with ethics is frequently very close, there seems to be a profound difference between the merely moral attitude of mind and that of religion. We might dwell once more upon the place of worship and redemption in religious life, but it is perhaps more striking to consider the question from the standpoint of conduct. The specifically moral state of mind is a reliance upon the ability of the will to respond to the appeal of duty or of the good, an attitude well summed up by Kant's phrase, " I ought, therefore, I can." In those religions which make explicit demands for righteousness, however, the attitude of the believer is quite different. The idea of " grace " here takes the place of the idea of the power of the human will. To be righteous I must have help from a " power not myself." The formula of religion is rather, " I ought, therefore God can."

What has often been called the " romantic " view of religion stands in sharp contrast with both the intellectual and the moral, since it regards " feeling " as the basis of religion and allows great value to the imagination (as distinct from " fancy ") which other views had treated as a dangerous ally. The leader of this school of thought has been Schleiermacher, whose two books, the *Addresses to the Cultured Despisers of Religion* and the *Christian Faith*, have exercised a profound influence on modern theology. According to Schleiermacher, religion has, as such, no necessary connexion with either intellectual insight or moral conduct, but is a kind of feeling which in his first book he described as a " sense and feeling for the infinite," and later by the formula " a feeling of absolute dependence." The distinguished living theologian Professor Rudolph Otto, in his well-known work the *Idea of the Holy*, has developed a theory which owes much of its inspiration to Schleiermacher but differs in essential points. According to Otto the basis of religion is a kind of feeling, but one of a specific type which cannot be described as one of dependence simply. For this specific religious feeling Otto has coined the word " the numinous feeling." It is a kind of fear, but distinguished from mere terror. In its lowest form we may describe it by such names as " the weird," " the uncanny," while in its highest manifestations it becomes awe and reverence. The core of this specifically religious emotion and the source of its difference from every kind of mere terror or mere consciousness of our dependence, is the feeling of " creatureliness," it is the reaction of the created to the presence of the Creator. Included within this numinous feeling is the sense of mystery which is never absent from genuine religion. The Divine is, in man's consciousness, *Mysterium tremendum et fascinans*, the Mystery which causes him to shudder and yet draws him towards itself.

It is clear that each of the theories which we have briefly stated has some basis of fact, and also that each by itself gives too narrow an interpretation of the nature of religion. Even though we may doubt the statement that some belief or creed is a universal characteristic of religion, it is doubtless true that religion does tend to formulate doctrines and that the higher religions are definitely committed to some general beliefs about the nature of Reality. We have only to think of the three universal religions, Christianity, Buddhism, and Mohammedanism, and of their difference from one another, to be convinced that there is an intellectual element in any developed religion. Nor does it need proving that every type of religion affects conduct, while the religions of civilized men are all " ways of life," and associated with a more or less definite conception of the meaning of the good life for man. But any satisfactory account of religion must conceive it as embracing the whole human personality and show how it engages the intellect, will and emotional nature when it is present in any complete way.

A positive answer to the question, What is religion? within our present limits must necessarily be somewhat dogmatic, and I must be content to state briefly a view which I have defended at some length elsewhere.[1] All the activities of man which can be described as " spiritual," the search for truth in science and philosophy, the appreciation and creation of beauty in art, the struggle for the good life in morality, appear to presuppose an essential condition. Throughout man feels, or " intuits," himself as in the presence of an Other : he is in relation with an object. Of course this " subject-object " relation is fundamental in every kind of experience, in that which is not, in our sense, " spiritual " as well as in the higher activities of mind. But in our spiritual activities there is the added feeling or intuition that the Other is in some way responsive to us. The " Other " with which we are in relation is not wholly alien to our minds, since we succeed in knowing it progressively but, so far as we can see, without limit. The " Other " is not wholly impervious to our judgments of value and ideals, for it is through action and reaction between the self and the " Other " that these value judgments have arisen ; and the world is certainly not entirely resistant to our ideals. In the experience of natural beauty, which is at the root of all art, we seem to have in a very direct way a feeling that the " Other " is responding to us.

Religion, it may be held, is the complete development of this intuition of " responsiveness," which is, in some form, implicit in all our spiritual activities. Man finds, or believes that he finds, in the Other the response to his needs ; not some of his needs only, as, for example, the need for truth, but to the whole body of his permanent aspirations. This would account for the fact of the development of religion, from a childlike and restricted state, that of " primitive credulity," to the highest levels of spiritual life. For man himself evolves, and as he evolves he becomes conscious of his own true nature and of needs which before had been hidden from him. The savage asks from his gods, long life, children, prosperity and the death of his enemies. The enlightened Christian finds in God the source of righteousness and the ground of truth. Thus religion from the earliest to the highest forms is a search for the satisfaction of human needs in the Other. But we shall totally misunderstand the nature of the situation if we think of the human spirit as developing by itself in complete independence of the Other. There is no such thing as the human self in isolation, there is no ego without the Other. Thus the development of religion is not only the progressive consciousness on the part of man of his own nature and needs, it is, at the same time, the progressive disclosure of the nature of the Other. Religion is both discovery and revelation.

We can now better understand a characteristic feature of religion which has often been used against it as a reproach—its " anthropomorphism." It is true that religion has always interpreted the Divine in terms of human life and experience. But the reproach is not justified when made in general terms, for clearly all human thought must be human, and if to be human is to be *ipso facto* wrong, then all our knowledge is false. Much religion has been justly accused of anthropomorphism in a more restricted sense, most frequently by such religious reformers as the Hebrew Prophets and Plato ; but the burden of their complaint has been that men have interpreted the Divine in terms of their own lower nature, they have thought of God as " even such an one as themselves." It is important to distinguish between the kind of anthropomorphism which is the mark of a primitive or degenerate type of religion and that which is inevitable and right. The development of religion to a state above that of superstition depends upon the passing from the lower anthropomorphism to the higher.

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[1] *God in Christian Thought and Experience*, Chap. I.

The interpretation which we have suggested of the nature of religion will permit us to attribute a value to two modern views which, at first sight, seem contradictory of one another. As we have seen, Schleiermacher considered that a " feeling of dependence " was the essence of religion ; but on the other hand, many modern authorities have held that the central element was not a feeling but a value judgment. Professor Höffding, for example, would describe religion as the affirmation that values are conserved. We are well aware that Christian conceptions of God have combined both these elements, holding that He is the ultimate Cause of all things and also the highest Value or Good. In all religion we may, I think, discover these two elements, though of course they take different forms in the varied theologies of the world. There is always the recognition of a Reality upon which I am dependent, and at the same time the acknowledgment that this same Reality is the source of the Good, so that my " salvation " depends upon my achieving some satisfactory relation with it. The fact that religion is concerned with value makes it impossible to adopt the formula " a feeling of dependence " without qualification, for the pursuit of values, the attempt to realise some good, is without meaning unless it implies the active willing of the human agent. Thus all religious experience involves the idea of a possible co-operation with the Divine will : it is not only dependence upon God but seeking to do the will of God. We must confess, therefore, that there is a paradox within religion which we cannot completely resolve. It appears when we try to think out any of the conceptions which are prominent in every civilized religion, *e.g.* grace and freedom, God and the world, revelation and discovery. But this is no proof that religion is illusory, since all the great and permanent activities of the human spirit lead us in the end, when we try to think them out, to mystery.

We have seen that it is possible to have a religious consciousness which is not associated with any definite and explicit belief, though the religious attitude will always be found to imply some belief. The intellectual element may, so to speak, be held in solution. But we have also observed that religion, being concerned with the whole personality, is normally associated with some intellectual formulation. The ideas of religion, and particularly the idea of God, are that part of religion with which philosophy can most directly deal, and the value of religion must depend, to a large extent if not wholly, on the validity of the ideas which are its intellectual expression. We must now turn to consider the idea of God.

II

The idea of the Divine is not, of course, necessarily the same as the idea of one God. Monotheism is a comparatively late development in the history of religious thought. Some students of comparative religions have indeed held that man began with a primitive monotheism, and so great is our ignorance of religious beginnings that it would be unscientific to deny the possibility of this view. On the whole, however, it seems more probable that the religious beliefs of mankind were, in the first instance, a vague conception of nature as animated by " spirits "—that man's first creed was " animism." From this starting-point it is not difficult to conjecture how the belief in " gods " arose, and the passage from animism to polytheism may in fact be traced with a high degree of probability. Doubtless many historical causes helped to carry the faith of the more advanced sections of the human race beyond polytheism to monotheism; but two causes have been constantly and universally at work. Polytheism cannot survive the growth of the moral consciousness and the critical intelligence. The polytheistic conception of the world outrages the demand for coherence, which is the motive of the intellect, and the demand for the supremacy of one law of righteousness, which is the inspiration of the moral consciousness. A world directed by many gods could not satisfy the philosopher, nor could it give any basis for the fully conscious moral life. We may see these tendencies at work in the literature of the two peoples who have contributed most of what is valuable in our civilization—the Greeks and the Hebrews. In the former the advance from polytheism to monotheism was chiefly the work of the philosophers and was never completely successful in the sense that it never displaced the earlier forms of religious belief and practice from the popular mind : in the latter the work was done by the unique line of Prophets whose conception of the God of Righteousness culminates in the doctrine of the second part of Isaiah.

Monotheism may take more than one form. The words " Pantheism " and " Theism " have come into use by modern writers to denote two different conceptions of the Divine Being, both of which affirm the doctrine of one God. Those views are called " theistic " which hold that there is one God who is the Creator or Ground of all finite existence, Himself in some sense distinct from the world. Theism has usually maintained that God is personal and that He must be thought of as morally good or holy. The word " Pantheism " covers a great many doctrines of God which have sometimes very little in common with one another ; but the essence of Pantheism is the denial of any real distinction between God and the world. Thoroughgoing Pantheism asserts that the All is God and God is the All. The various ways in which pantheistic conceptions have been presented and worked out lead to the most remarkable differences of emphasis. Some pantheistic theories are hardly distinguishable in their consequences from materialism, while others form the basis of the most extreme mysticism, which dissolves the world of experience into mere illusion. It is significant that the pantheistic philosophy of Spinoza has been accused both of " atheism " and of " acosmism," of the denial of the reality of God and of the denial of the reality of the world.

Pantheism in every form is open to grave objections. It is clear that on every pantheistic hypothesis the freedom, and therefore the responsibility, of finite persons must be an illusion, for they are by nature parts or aspects of the One Divine Reality. Not only does a pantheistic view tend to destroy the reality of the moral life, it tends to abolish the distinction between good and evil and affords no basis for our judgments of value. If all is Divine, then every aspect of the all must be a revelation of the Divine Reality, and the difference, which to us seems so important, between right and wrong, good and evil, must be only a distinction from our point of view, not grounded upon the nature of things. We shall have to return to this subject again when we deal with the transcendence and immanence of God.

Belief in one God Who is the Creator or Ground of all existence is a tenet which is probably comprehensible only to a relatively advanced intelligence and is capable of criticism and theoretical defence. Certain well-known arguments for belief in God have played a great part in the history of religious thought and must be briefly noticed here ; but before we consider them it will be necessary to make two remarks. First, if the position which we have briefly stated in the preceding section of this essay be accepted, it is obvious that the main justification for belief in the existence of God is religious experience itself. In so far as man is a religious being, and is conscious of that responsiveness in the Other to which we have referred, he is impelled to interpret his experience and finds implicit within it some beliefs about its nature. Arguments for the existence of God are confirmations of what is, in some sense, already known. Secondly, there has been in recent years a change in the method of approach to the problem of the existence of God, and consequently in the use made of the traditional arguments. The " rational " arguments were formerly supposed, *e.g.* by Thomas Aquinas and Leibniz, to give a direct demonstration of the existence of God, a demonstration so cogent that no one who understood them could reasonably fail to be convinced by them. The modern mind, influenced by the prevalence of the scientific method, thinks in a different way. To it the question presents itself more naturally in the form : given the Universe, to find the most probable hypothesis to account for it. Among the possible hypotheses is that of Theism ;[1] and the arguments may be regarded as lines of thought by which it may be shown that the hypothesis of God is more reasonable than any other. This point has been fully explained by Professor Sorley in his *Moral Values and the Idea of God*, and the change in method has been clearly stated by Professor Whitehead in his *Science in the Modern World*.

The three arguments for the existence of God which have been styled the " rational " arguments are the Ontological, the Cosmological and the Teleological. The first proceeds from the idea of God in the mind to infer the reality of God : the second argues from the existence of the Cosmos that there must be a First Cause or Ground : the third reasons from the evidence of purposiveness in the world to the conclusion that there is a purposive Mind behind or within it.

The Ontological argument first made its appearance in the writings of St. Anselm, though hints of similar trains of reasoning can be found in earlier writers. Anselm argued that even " the fool " who says in his heart that there is no God has the idea of God, for otherwise he could not mean anything by his statement. But the idea of God is the idea of " that than which nothing greater can be conceived." Now this being must exist, it must be not only *in intellectu* but *in re*, not only " in thought " but " in reality," for if it does not exist *in re* it is not " that than which nothing greater can be conceived." We could go on to conceive a being which was both *in intellectu* and *in re*. As the result of criticism Anselm made it clear that his argument was not applicable to all ideas but only to that of the absolutely infinite and perfect. It could not be used, for example, as Gaunilo suggested, to establish the existence of a perfect island. The subsequent history of this famous argument has been chequered. Rejected by Aquinas and the later mediæval theologians, it came into prominence again in the seventeenth and eighteenth centuries and formed an essential part of the systems of the three greatest thinkers of that epoch, Descartes, Leibniz and Spinoza. Kant directed a destructive criticism against it towards the end of the eighteenth century, but it was rehabilitated once more by Hegel, who regarded it as the foundation of all philosophical thought.

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[1] By Theism we mean the view that there is a personal and creative God Who is both transcendent and immanent. See Section IV. of this Article.

It cannot be said that modern thought has reached any agreement concerning the value of the ontological argument, and distinguished philosophers are still divided into those who regard it as a verbal juggle and those who hold it to be, in some form, the basis of philosophical construction. The essential element in the argument is its insistence on the idea of the perfect and the absolute as a necessary idea, one which the mind cannot help having. It may be pointed out that in all our thinking there is implicit the idea of the absolute. The conception of truth seems to involve the thought of an absolute truth, the conception of value involves the thought of an absolute value, nor would the ideas of partial truth and imperfect values have any meaning apart from the concept of that which is neither partial nor imperfect. As Descartes argued, how should we know ourselves to be finite unless we had already the idea of the infinite ; and from what experience of ours could the idea of infinity and perfection be derived ? Perhaps we get at the heart of the ontological argument when we put its essential thought in a different way. It is really an attempt to state in the form of reasoning two different pieces of true insight. In the first place, there is, inherent in the self-conscious individual, an intuition of his relatedness with an Other who is not wholly other, a Beyond that is within, and hence an immediate consciousness of a Reality in which the deepest and permanent needs of the self are satisfied. In the second place, all thinking and knowing depend, in the last resort, upon an ontological assumption. We must begin by taking for granted that the world is really knowable by our minds, that it is rational. This is an assumption which can never be proved, because it is itself the presupposition of every possible proof ; but we may say that the existence of a rational order is verified by every advance of knowledge. The ontological argument cannot be safely dismissed as valueless, for if we do so, we are in danger of striking at the root of all thinking.

The Cosmological argument, which was formulated by Plato and elaborated by Aristotle, has generally been stated in the form of an argument to a First, or originating, Cause. Aristotle used the idea of motion, and argued that there must be a Prime Mover who was the ultimate source of every motion in the world. This Prime Mover must be himself unmoved, since otherwise there would be needed another source of motion prior to him. The cosmological argument was the chief basis of the rational argument for the existence of God which Aquinas regarded as conclusive : it was the core of that " natural theology " which, apart from revelation, was able, it was believed, to arrive at the truth that God is and that He is one. In the exposition of the argument by Aquinas we find it presented in four distinct forms. In addition to the Aristotelian argument from motion we have the same argument stated in terms of efficient cause—there must be a First Cause—contingent and necessary being, and value or " perfection." The cosmological argument has been the common instrument of all constructive philosophies, for every attempt to " explain " the world of our experience as a whole must be some kind of argument from it, as experienced, to some ground or cause of its existence.

The traditional statement of the cosmological argument has almost invariably introduced the conception of a series which, it is argued, must have a beginning. There is a chain of causes which leads us to the First Cause, or there are a number of communicated motions or changes which lead us, on reflection, to postulate a Prime Mover. The argument stated in this manner is open to several serious objections which were pointed out by Kant. The unending series of causes or motions is, it is alleged, unintelligible : but, it may be replied, the idea of an uncaused cause or an unmoved mover is no less unintelligible. Further, the conception of cause is by no means so clear and self-evident as is assumed in the traditional cosmological argument, and the Aristotelian idea of efficient cause has almost disappeared from modern scientific theory. Again, even if the argument be conclusive, it may be questioned whether it would lead us to the thought of the God of religion. " And this all men call God " is Aquinas' formula at the end of each statement of the argument. But here he discloses his unconscious reliance upon religious experience and tradition. But that the idea of God was already present in their minds, men would not necessarily identify the first member of a series of causes with God. Kant was right when he said that the cosmological argument really presupposed the ontological argument.

If we ask ourselves whether the cosmological argument retains any value in the light of modern thought, we shall not be able to give a satisfactory answer unless we generalize the line of thought which it represents and free it from some of the limitations which have been the object of criticism. The essence of the argument is simply that " nature," " the world," or the " universe " is not a self-explanatory system : in order to interpret it we are compelled to postulate the existence of a Mind which is not identical with nature. In the more technical language of philosophy, we may say that the argument is the attempt to show a necessary transcendent reference. Plainly, this is a much more complex matter than the old cosmological argument. To state it fully would require a survey of all the possible ways of seeking to interpret the universe and an attempt to demonstrate that all of the interpretations, except that which postulates a creative Mind, are untenable. Any such lengthy investigation is far beyond the limits of this article. We must be satisfied here to draw attention to the current tendencies of thought which are, to a degree not generally realized, in harmony with this enlarged cosmological argument.

The philosophy of nature, after being the plaything of philosophers and the scorn of scientific specialists, has within the last twenty years come to occupy the forefront of the intellectual stage. The reason for this is that science itself has found that it cannot pursue its legitimate investigations without raising some of the most profound philosophical problems, and moreover, the progress of science, particularly of physics, has seemed to throw light upon those problems. The conception of " nature " has often been taken as one which is clear and sufficient, and it has been uncritically assumed that we need no further account of the purpose of science than that it seeks to understand " nature." This was perhaps plausible so long as the old-fashioned materialism could be maintained and nature could be regarded as a mechanism. The foundations of materialism, however, have now been destroyed by the results of the research into the atom and the equally revolutionary views of space and time to which physics has been led.[1] The conclusion from this is not, of course, that scientific research can ever prove or disprove the existence of God ; but the disappearance of the conception of nature as mechanism should bring more clearly before our minds the ultimate problem of explanation. It might be argued that a mechanism is self-explanatory, since every part is determined by its relation to the whole. Even so, of course, only a very superficial reflection would be satisfied that a mechanism raises no problems, since we cannot conceive a machine which is not put together and set going. But the position into which the more recent study of nature is taking us is one in which we are almost compelled to face the question whether we are not forced to postulate Mind as the ultimate reality and conceive nature as a complex thought. To such a conclusion at least Professor Eddington and Sir James Jeans tend. The more definitely metaphysical researches of those who are professedly philosophers of nature support this conclusion. The most distinguished of these, Professor A. N. Whitehead, finds it impossible to complete an account of the natural order without assuming the existence of that which is " beyond nature " in any ordinary meaning of the word. We cannot make sense of nature, Whitehead holds, without the assistance of conceptions which transcend nature—that of " eternal forms " and that of God.

We may conclude from this brief estimate of modern tendencies in the philosophy of nature that the value of the cosmological argument is by no means destroyed, but, on the contrary, in its generalized form it is being re-enforced by scientific progress. We must, however, once more remind ourselves that a complete statement of the argument in its modern form cannot be attempted here. To do so would mean to criticize all the philosophical theories which have claimed to answer the problem of Reality without the idea of God, including those which are not directly concerned with natural science. We should have to show that whatever line you choose to pursue, whether you think of reality as " life " or as

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[1] See the Articles on *The Physical Nature of the Universe*, p. 91, and *Astronomy*, p. 134.

" history," to complete your explanation you must bring in a " transcendent reference " ; the existence of Mind beyond the living beings of experience and beyond the process of history is inevitably suggested.

The Teleological argument, popularly known as the argument from design, has been the most effective with the plain man and has, in common belief, been the most severely battered by modern knowledge. In general the argument has been from the facts of order and adaptation to ends to the Source of Order and the Purposive Intelligence. Before the rise of the biological theory of evolution, the argument was most frequently founded upon particular instances of adaptation, as for example, Paley's favourite illustration, the human eye. The general acceptance of a theory of evolution has almost entirely destroyed the cogency of this type of reasoning, for we know that the eye has developed through many stages from rudimentary beginnings, and that it has been, to some considerable degree at least, determined in this development by "natural" causes. It is no longer possible to point to the eye as direct evidence of an intelligent Creator. The problem raised by the teleological argument, however, cannot be so easily dismissed. The two questions still remain : Is there evidence of a tendency in evolution itself towards the production of " values," of higher types of existence and experience ? If there is, how is this tendency to be explained ?

The answer to the first question appears to common sense to be obvious. We should agree that human life and experience is of a different and higher quality than that of the amœba, and further that there is no reason to suppose the progress in the creation of values to have finished. It may, however, be urged that these higher values are the result of accident and give us no ground for supposing, so to speak, that the universe is interested in their production. There is no complete answer to this. It cannot be demonstrated to be absurd : but such a supposition will appear to most to be improbable, and this feeling of its inherent unlikeness will be reinforced when we consider some of the consequences of the hypothesis. Knowledge is one of the values which have been evolved ; and if we are determined to believe that all value is the accidental by-product of an indifferent process we must logically include science itself among the accidental by-products. In this case it is difficult to see how science could claim to be true, or rather what the meaning of that claim would be. And if science cannot claim to be true, then we know nothing about evolution and the whole position becomes self-contradictory. The most reasonable hypothesis then is that values are not accidental by-products but integral to the process of evolution. One of the facts therefore about evolution, and obviously one of the most important facts, is that it tends to produce values.

We proceed to the second question. How shall we best explain the tendency to produce values ? The theory of evolution is at the present moment a subject of acute controversy among both biologists and philosophers, and we have to confess that in this as in other respects we are living at a period of transition. Here too the controversy is between the older theory of mechanism and other views which may be less clearly articulated but seem better to cover all the facts. The theory of " emergent evolution " has recently been made prominent by the writings of Professor S.

Alexander and Professor C. Lloyd Morgan. The concept of " emergence " is intended to meet the difficulties which the older theories of evolution encountered in connexion with the facts of the coming into existence of specifically new qualities and values. It is proposed on this theory to regard the process of evolution as something more than a mechanistic development. According to the new theory evolution has the property of bringing into existence beings which could not have been foreseen by anyone who knew the previous course of development and which, in fact, are not the mere " resultants " of prior conditions. Thus it may be said that life, consciousness and self-consciousness " emerge " in the course of evolution. The theory of emergent evolution may be welcomed as a descriptive formula. It is obviously more in harmony with the facts of experience than the mechanical theories which it hopes to displace. But no reflective person can regard it as anything more than descriptive. It would be an absurd claim, if it were made, that " emergence " really solves any problems ; for the question still remains, Why has evolution this quality of emergence ? The point at issue is simply this : What hypothesis will best explain this admitted tendency to produce higher qualities of life and experience ? We do not solve a problem by inventing a new word for it.[1]

Once again we are brought to the hypothesis of God as the most reasonable explanation of certain aspects of the world. The teleological argument in its modern form does not profess to be a demonstration, but to be one among many considerations which converge upon the idea of God. The admission of any teleological element in evolution, of any tendency towards the production of value, suggests the thought of creative Mind. The activity of purposive intelligence would at least be an explanation, and it is not obvious that there is any other.

The rational arguments, we may conclude, have been considerably modified by the new situation created by modern science, and they will be employed in a somewhat different manner from that of the mediæval philosophers by an enlightened philosophy of religion ; but they still have great value and conspire to support the theistic view of the world. They have not, however, been in fact the chief corner-stone of religious thought since Kant effected his " Copernican revolution." Since his time theologians have preferred to place in the forefront of the battle for religious faith the Moral argument.

We have already remarked that Kant criticized adversely the rational arguments for Theism in their older form. It was not, however, in the interests of Agnosticism that he conducted his campaign, but rather in order to transfer the weight of the defence of religion to the sphere of morals, " to make room for moral faith." The precise line of reasoning which he adopted is too closely identified with his own peculiar views of the nature of knowledge and of the moral consciousness to be generally acceptable to modern thinkers. In essence, however, his contention may be stated in a way which would be widely approved. If we accept the experience of our moral consciousness as it stands, we find that we are under an absolute obligation to obey the dictates of duty ; the moral law comes to us in the form of a " categorical imperative," that is to say, the moral law appears to us as an unconditional demand. It comes not with a command in the form, " Do this if you want that," but simply " Do this." At the same time, however, we cannot avoid the conviction that the life of dutiful obedience to the law of right is a rational one. But if we think out the implications of this conviction, we find that there are three postulates which we are compelled to make—God, freedom and immortality. In so far as I am a self-conscious moral being, I have the sufficient ground for belief that I am a free agent, with an unlimited destiny and under the providential government of God.

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[1] For an exposition of the theory of evolution see the Article on *Biology and Human Progress.*

The train of reflection thus inaugurated by Kant may be pursued along somewhat different lines in view of the changed intellectual situation. We may pursue first the line of thought lucidly stated by Lord Balfour. The fact that moral ideas have evolved and that conceptions of the good life have not always been the same may seem, at first sight, to be a serious difficulty in presenting a moral argument. Reflection, however, will show that, if we still retain the conviction that we are under an obligation to pursue the good as we understand it, the evolution of moral ideas affords a ground for belief in a providential ordering of evolution. If the evolution of moral standards were the result of merely non-moral and indifferent causes, if the changing conceptions of good were nothing more than the outcome of a process which had no spiritual direction, we should be at a loss to justify any recognition on our part of absolute obligation. To understand the nature of moral ideas and the laws of their change would be to weaken their authority over us. If, however, we take it as a fact of experience, which we cannot ignore without denying our own true nature, that we are really under an obligation to obey the right as we see it and to see the true meaning of right so far as we are able, then we must believe that the development of human conceptions of the good life is a directed development, the progressive revelation of a good, which, in some way, transcends the process of evolution. Thus any theory of the development of the moral consciousness of man which does not deny, or at least weaken, the sense of obligation must be a theory which finds a moral or spiritual background to that development.

Even more clearly is a belief in God suggested and supported by a consideration of the moral consciousness in its purest forms. It seems evident that the effort of the moral life is directed towards some end : it presupposes, at least in idea, some absolute and final good in which the aspiration of the moral self would find satisfaction. If we ask what that absolute good and final end would be, we are at a loss to describe it in terms of our human experience. Whenever we try to imagine a condition of perfection as existing in time, we are conscious that we are engaged upon an impossible task, for there is always something better which could be imagined. This may be illustrated by the case of social progress. We should admit that an essential part of the aspiration of the good man is that the social life of humanity should approach nearer to its ideal. But the attempt to conceive a human society under the conditions of time and space which could be called ideal is beyond our power. It is plain that an intercourse of persons with one another, free from all defects and achieving the maximum of joy and peace and creative fellowship, is not possible, even though our power over nature and over ourselves were indefinitely increased. If then the end of the moral life is attainable, it must be attained in the unseen and eternal sphere : but if it is not attainable, the moral life must be regarded as not fully rational, as inspired by a hope which is, by its nature, incapable of realization. If we persist in relying upon the conviction that the moral effort is both obligatory and rational, we are compelled to postulate a perfection beyond the present and visible order, some Kingdom of God or city eternal in the heavens. The principle which we have illustrated by the example of the social idea is applicable to the whole range of moral good. Wherever we come across heroic virtue, such devoted goodness as we might describe as saintliness, it appears always to be directed towards, and inspired by, a Good which can never be fully realized in time. It goes beyond any formulation of the end in merely temporal terms. It has a touch of the supernatural. On this fact of experience the moral argument for the existence of God is based.

Recent philosophy of religion has been more prone than formerly to recognize that the Good, as Plato and the Greek thinkers generally held, includes the beautiful. The interpretation of the fact that we apprehend beauty and that one of our spiritual activities is the creation of beauty[1] has, of course, been the subject of much controversy, and it would be absurd to allege that Theism alone holds the field ; but it is at least true that Theism can give an account of the matter which meets the exigencies of our experience. Here again we may with Plato find a ladder which leads from partial and imperfect beauty to the absolute Beauty. The beautiful and the sublime in nature have been the source of religious experience to " nature mystics " such as Wordsworth ; but they may also be the starting-point of an argument from analogy which has at least some force. One of the theories of the nature of beauty is that it consists in expression. If this be true, then the beauty of nature may reasonably be conceived as itself the expression of a Divine artist or poet.

The arguments for the validity of the idea of God are of a cumulative character. Modern religious philosophy does not claim to possess a single line of reasoning which alone is sufficient. It would suggest rather that among all the possible hypotheses to answer our problem of the meaning of the world and of life, the hypothesis of God, when all the data are considered, is the most reasonable. Few modern philosophers of religion would deny that there is always an act of faith in the affirmation of God's reality. We can never know that God exists in the sense that we can prove the proposition by a chain of deduction beyond cavil and theoretical possibility of error. In the end there is always an act of will which decides to adopt " the nobler hypothesis "—but it is a rational act of will and is logically no more unreasonable than believing in the existence of other people, a proposition which is itself incapable of rigid proof.

A complete statement of the argument for Theism would include a criticism of rival hypotheses such as materialism and dualism. For such criticism we have here no space, but it is necessary to mention one view which is not so much a rival hypothesis as a contention that all hypotheses are worthless. Agnosticism was the name invented by T. H. Huxley (under the mistaken impression that *agnosco* in Greek means " I don't know ") to describe the standpoint that all knowledge of the nature of ultimate reality is impossible, and that we shall be wise to accept the condition of ignorance as a necessary consequence of our position as men. Much confusion is caused by the use of the word in various meanings which are not carefully discriminated. In one sense every intelligent believer in God must be agnostic, for he will readily confess that the Divine Nature cannot be completely known to man and that mystery will remain, however much the mental and spiritual powers of created beings may be improved. To hold that we have some knowledge of God is not equivalent to holding that we have or can have a complete knowledge of Him. Nor again should agnosticism mean that we are in fact ignorant of the Divine Nature, for it might be held that, though we are completely without knowledge of God now, there is a possibility that hereafter some knowledge will be attained. Agnosticism in its proper sense, that all knowledge of ultimate Reality is as such beyond our compass, is in the nature of things a contradictory doctrine. If I know that I cannot know ultimate Reality then I know enough of the nature of ultimate Reality to know that it is unknowable by me. There can be no other ground for the universal statement that Reality is unknowable than the knowledge of some quality or property of Reality which renders it unknowable. Thus, in the same breath, I am asserting both that I know ultimate Reality and that it is unknowable.

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[1] The subject of " Beauty " is discussed in the Article on *The Principles of Literary Criticism*, p. 903.

The only consistent Agnosticism is a practical attitude. I may conclude that the problem of Reality and of the meaning of life is so difficult and obscure that I shall be well advised not to think about it, or that the arguments are so evenly balanced that I should keep an open mind without embracing any positive belief. But even this practical agnosticism is not so easy to carry out as might appear. For the judgment which I form concerning Reality cannot be a merely theoretical one. My reaction to the whole of my life-experience, for example, will be affected by whether I believe in God or not, and by what kind of God, if any, I believe in. A mere refusal to think about Reality, or a genuinely balanced mind between alternatives, is not in practice a non-committal attitude. For practical purposes I have chosen the negative side of the question. It may be doubted, therefore, whether there is any rational being who has not some belief about the nature of Reality and the meaning of life which is practically potent, though perhaps intellectually incoherent and even unconscious. We are all believers, though many of us are not aware of what it is in which we believe.

III

The modern world has seen a considerable movement of dissatisfaction with the great organized and institutional forms of religion and with the conceptions of God which they have put forward in traditional creeds ; but, at the same time, there has been an almost equally considerable tendency to recognize the importance of religion in human life and to admit the need for some substitute for the worship which the ancient churches have existed to maintain. Thus the definite antagonism to all religion, which was common in the nineteenth century, is not perhaps so rife at the present day among intellectuals. For various reasons the conception of a personal God has been a chief stumbling block. We are therefore confronted with numerous attempts to retain the religious inspiration without the belief on which that inspiration has, for the most part, in the past been nourished. We must consider briefly some forms of this " religion without God."

That religion can exist without any belief in God is evident from its history, for in Buddhism, as originally taught by its Founder, there is before us a doctrine which might even be called, without much exaggeration, atheistic. It must be confessed, however, that primitive Buddhism seems to stand alone among historical religions in having no doctrine of god or spirit ; and the later Buddhism has departed from its beginning in this respect. In modern times a movement which for some years had a great influence was the Positivism preached by Auguste Comte. Comte combined in his thought the two tendencies to which we have already drawn attention, that of respect for religion and distrust of theology. In his opinion the progress of human knowledge passed through three stages—the theological, the philosophical, and the " positive " or scientific. It was, he held, now plain that the only knowledge open to man is the positive knowledge of science, and that all doctrines of God must be dismissed as probably illusory. Yet the religious impulses of mankind were of the first importance and essential to social progress. He proposed therefore as a substitute for Deity the *Grand Être*, Humanity, as the object of devotion and worship. Let us transfer the religious emotions from the Deity of the traditional religion to the conception of humanity as a whole. For purposes of devotion Comte allowed the use of the images and examples of particular individuals who had contributed to progress or exemplified in a striking manner ideal human qualities.

We need not stay to describe the details of the positivist worship, since the creed and cult, as Comte conceived them, have ceased to be of any importance. The system has suffered from two defects which have become obvious in the course of discussion. First, the idea of Humanity as an object of worship opens up insoluble difficulties. Humanity, as we know it, does not appear worthy of worship, and if we amend our creed to indicate that we worship idealized humanity, we are confronted with the somewhat remarkable demand that we should worship what, in the theory of Positivism itself, does not exist and is, moreover, incapable of being adequately described. Secondly, the idea that scientific knowledge is alone positive has suffered serious damage through the progress of science itself. As we have seen, it is by no means the case that scientific theories raise no problems about the nature of things ; on the contrary, research leads to those problems. There is also grave difference of opinion among students of natural science concerning the status of scientific knowledge. It is maintained by many that science can never be more than an abstract and descriptive series of formulas. There is therefore a need for philosophy in some deeper sense than a synthesis of the results of science, which was the humble rôle assigned to it by Comte. The general aim of Positivism has not, however, ceased to secure adherents, and some of its leading thoughts, though transformed, appear in the contemporary movement for religion without God which may be described as the religion of evolution.

As we have already remarked, the conception of evolution has not remained always the same, and at the present moment there is a widespread tendency to revolt from the purely mechanistic idea and to adopt ideas of a " vitalist " or " emergent " kind. The older conception of the " orthodox " evolutionists, that the process of evolution can be regarded as, in the last resort, explicable by the laws of mechanics, has now been seriously shaken, and the " vitalist " and " emergent " theories have gained adherents both in scientific and philosophical circles. According to the former view, the evolutionary process is the development and progressive expression of a " life-force " ; according to the latter view, the process of evolution is not explicable wholly by laws of matter and motion, but has the property of giving rise to new forms of existence which could not have been predicted prior to their occurrence. The two theories are by no means identical, though they have important agreements with one another, and so far as their implications for religion are concerned, may be considered together. This change in the concept of evolution, which may or may not prove to be permanent in the sphere of science, has furnished a basis for a " new " religion. Obviously, so long as the process of evolution is regarded consistently as purely mechanical, there is little ground for finding an object of religious emotion in it, for few men would be willing to worship a machine, and probably even those few, like the man in Mr. Wells' story, *The Lord of the Dynamo*, only because they did not really think of it as a mere machine. The only worship possible in the case of a mechanical process of evolution would be that of the Maker and owner of the machine. When, however, any kind of " teleological " view of evolution is held the situation is radically changed. It is possible then to conceive religion as the service of those ideal tendencies which can be discerned within the process, as co-operation with the Life Force, or as the reaching forward in aspiration to that better life which is to be created by the process. A view of religion of this type has influenced much contemporary literature and is implied in many of the writings of Mr. G. B. Shaw and Mr. H. G. Wells.

The religion of evolution can justly claim to meet some of the requirements of the religious consciousness. It affirms the truth of the intuition that we are able to co-operate with an immanent purpose in the world, and that our good and happiness will be found in so doing. That side of Christian faith which centres upon the idea of working in the Spirit for the Kingdom of God, receives here an interpretation which is not without religious value. The religion of evolution, however, is grievously lacking in other important elements which have entered into the experience of God in the higher religions. Since the evolutionary creed rules out the conception of a Deity who is above the process, it can give no countenance to the belief that the law of righteousness is founded in eternal Reality ; if all is in flux and evolution, the very standards of judgment themselves must be involved in the stream of ceaseless change. Nor again can the religion of evolution allow the belief that there is an ultimate

Good towards which the efforts of finite beings to attain any good are tending. There can be no final vision of God in which the soul may know itself to be no longer *in via* but at last *in patria*, no longer on its pilgrimage but at last in its motherland. Nor again, can this type of religion justify any sense of dependence upon a Being infinitely greater than ourselves. The only dependence which it can recognize is a dependence upon the evolutionary process which, according to this hypothesis, is unconscious and therefore below the level of our own being.

A strange suggestion has been made by Professor Alexander. He proposes that we should attach the word " deity " to that higher type of being which, so to say, is waiting to be evolved, that with which the evolutionary process is now in travail. When the next stage is reached, " deity " will once more be transferred into the future, and worship will be directed towards the still higher yet to come. It would seem that this conception of deity labours under every kind of disadvantage, for, on this view, " deity " is both non-existent and unknown. It is non-existent because, by definition, directly it begins to exist it ceases to be deity; and it is unknown, because, according to Alexander, we have no idea what the next step in evolution will be like. It is perhaps not surprising that, so far as is known, few temples have been erected for the worship of the god who never is but always will be.

It should not, finally, escape our notice that the " religion of evolution " depends, in the last resort, upon an act of faith at least as much as the more orthodox belief in God. The upward tendency of evolution, it must be assumed, is not merely a temporary fact of the period and place in which we happen to be, but is, on the contrary, a permanent quality of the universe. It may be so, and on the hypothesis of Theism, there is good ground for believing that it is so ; but simply on the basis of empirical observation there seems singularly little reason for holding so optimistic a creed, and in so far as science can make any pronouncement, it appears still to be on the side of those who believe that the universe is " running down," tending towards a state of equilibrium in which all life, and therefore all value, will be abolished.

IV

The problem of the Divine Nature has not ceased to exercise the minds of philosophers, nor will it ever cease to do so, for the Being of the Creator must always present a depth of mystery which cannot be completely grasped by created intelligences. The difficulties and apparent contradictions into which we fall when we try to elucidate the conception of God, have always been a principal argument in the hands of those who would push beyond the thought of God the Creator to the thought of the Universe or the Absolute as the ultimate Reality. Pantheistic types of thought (using the word " Pantheism " in a wide sense) have had distinguished exponents in the last generation.[1] Idealistic philosophy in the works of F. H. Bradley, Dr. Bosanquet and other followers of the Hegelian tradition, has been deeply sympathetic with the religious consciousness and has professed at least to be maintaining its value and legitimacy even while drastically criticizing its conceptions. According to this view, in its most coherent form, the sole reality is the all-inclusive and timeless Absolute, of which all other things are " parts " or " appearances." Thus the finite self, though not an illusion, is not finally real, and the God of religion is indeed more real than the person who worships Him, but again not finally real or true. In religion, it is suggested, we have the representation, necessarily imperfect and symbolical, of the Absolute, which is itself not a possible object of worship. The apparent paradoxes of religious faith and practice have been freely used by thinkers of this school to support the view that Theism is not in the end true. More recent movements of thought, however, have given evidence of a general reaction against Absolute Idealism. It has been objected against it that the doctrine of the Absolute, as alone completely true and real, may properly lead to complete philosophic scepticism, to the conclusion that we can have no genuine knowledge at all. The theory has also been the object of damaging attacks from the standpoint of logic, while its implications for the moral life are too obvious to need comment. We cannot here enter upon the intricate and technical discussions that have led to the retrogression of a type of philosophy which a few years ago was dominant in England, Scotland and America ; we may note, however, that the way seems to be open for a positive and constructive statement of a philosophical Theism.

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[1] Pantheism properly means the theory that God is identical with " the All " or " the Universe." Bradley and Bosanquet are not in the strict sense Pantheists, because of their doctrine of " degrees of reality."

For modern reflection, the problem of God seems to centre in the main upon two questions—personality and creation.

The debate on the subject of Divine Personality has been confused by much misapprehension and prejudice. It has been taken for granted by critics that those who hold to the personality of God mean that, in their opinion, God is a person identical in qualities with human persons, only very much larger and more powerful. On this assumption, it has been pointed out that the universe as we know it could scarcely be conceived as the work of such a being, and the idea of the personality of God has been dismissed almost without argument. A moment's reflection should have been sufficient to convince any candid critic that this is not what intelligent men have understood by the personality of God. Orthodox Christianity, as is well known, holds that the Godhead is not a person but rather a Unity of Persons. The religious interests involved in the discussion of the personality of God are chiefly two. The most intimate type of religious experience, and most, if not all, kinds of prayer, seem plainly to involve a personal relation with God. It is difficult to suppose that prayer addressed to an impersonal principle could long be maintained. Secondly, the idea of God, if it is to be an adequate idea, must be the idea of the highest and best Being conceivable. Now personality is admittedly the highest type of concrete being with which we are acquainted, and hence we are compelled to maintain that God cannot be less or lower than personal. There is no reason why religion should object to the description of God as a " super-personal " Being, so long as it is understood that " super-personal " includes " personal " and is not a polite synonym for " impersonal."

The two " interests " of religion are, from another point of view, the chief reasons for holding the truth of Divine Personality. A total rejection of all religious experience as illusory would, of course, entirely destroy the force of the first of these two considerations. If, however, we attach some value to religious experience and therefore conceive it to have some permanent relation with Reality, the fact that a large mass of this religious experience, that which is most highly developed no less than more primitive forms, builds itself up round relations with the Divine which have the " warmth " of personal intercourse, must weigh very greatly with us. It would be a paradoxical position if religion had a content of truth but, in its highest and most effectual exemplifications, were founded upon a mere mistake.

The more strictly philosophical argument for Divine Personality depends upon a principle which in mediæval thought received the name of the *via eminentiæ*. The general idea of this method of theological reasoning has been stated most simply by the Psalmist when he exclaimed : " He that made the eye shall he not see, and he that planted the ear shall he not hear ? " and by Jesus, more accurately, in His question, " If ye, being evil, know how to give good gifts unto your children, how much more shall your Heavenly Father ? " It must be admitted by any thinker who allows that we can have any knowledge of God, that the highest and best things in creation will give us the analogies by which we may most adequately conceive the Divine Nature. Thus it has been urged by the mediæval Scholastics that, in attempting to determine the Divine Being by the processes of reason, we must take every " perfection," *i.e.* every valuable quality, which we find in created being and attribute it " in a more eminent manner " to the Creator. That is to say, we are to free the quality in question from all the limitations of finite existence and conceive it as perfectly realised in God. If we take the quality of " knowing " as an example, we must think of the Divine Wisdom as without limitation, unconfused, unmingled with ignorance, and needing no train of reasoning to arrive at its conclusions. It will be not " discursive " but " intuitive." We may confidently affirm that any one who denies the legitimacy of the *via eminentiæ* in some form must logically either be an agnostic or rely solely upon " revelation " for knowledge of God.

We may assume that personality is the highest form known to us of concrete and living being : in fact personality might be defined as the highest and most complete way of being alive. We may conclude then that, if God is living, He cannot be less than personal. There are, however, sufficient signs that human personality is not the most perfect form of personal life which we can conceive. Though the precise nature of personality evades accurate definition, we can enumerate certain qualities which appear to be characteristic. Personal life is the life of a self-conscious being, who is capable of directing himself by principles or ideals of conduct. A person is one who is able to know and to will. We immediately predicate personality when we feel justified in assuming moral responsibility. It is plain that personality exists in ourselves at best in a strangely imperfect form. Even the most consistent character and life are, to some extent, incoherent. Of the best man we must say that he has not shown us the full possibilities of personal life. It is, therefore, clear that in attributing personality to God we are by no means making Him " one of ourselves " ; on the contrary, we are recognizing the existence of a Being who, while not entirely other than ourselves, surpasses and transcends us immeasurably.

The metaphysical discussions which have been evoked by the doctrine of the Divine Personality have led to many intricacies which would be out of place here ; but there is one disputed point which must be mentioned. It has been alleged that personality and self-hood are conceptions which can only be applied to limited beings, that in fact the idea of an Infinite Person is self-contradictory. In support of this contention it has been frequently alleged that there can be no self without a " not-self," and that in fact those activities which we have recognized as being the peculiar marks of personality are impossible unless there is something, some sphere of reality, from which the person distinguishes himself. Thus, both in knowing and in willing we seem to need an object which is not identical with ourselves. Three different answers to this objection have been made. (1) It has been held by religious thinkers who follow the Hegelian tradition that, though personal analogies are the best which we have for interpreting to ourselves the Nature of God, they do not take us all the way, and we must confess, in the last resort, that the Divine is supra-personal, existing in a mode which is higher than personal. (2) It has been argued by Hermann Lotze and many other Theists that perfect personality, so far from being incompatible with infinity, is only possible for an Infinite Being. " Perfect personality is in God only ; to all finite minds there is allotted but a pale copy thereof ; the finiteness of the finite is not a producing condition of this personality, but a limit and a hindrance to its development." (3) Some Theists, among them the late Dr. Hastings Rashdall, would accept the contention that the conception of a personal Deity carries with it the implications of some limitation of the Divine Nature, and would distinguish sharply between God and the Absolute. Those who take this view generally attempt to preserve the ultimate dependence of all things upon God by the conception of a self-limitation of the Divine Being.

It is not possible here to summarize the reasons which may be alleged for and against the different theories which we have now briefly stated, for it is obvious that the questions at issue cannot be discussed without raising the most complex problems. We may, however, note that it would seem essential for any Theistic belief to distinguish between God and " the universe." Whatever we may choose to mean by the word " universe," it cannot be identified with God unless we are prepared to accept Pantheism. To identify God with " the All," or the sum of things, would be to abandon the chief element in the Theistic position. In some sense, then, it would seem there must be a distinction between the Creator and the created, between God and the universe. It may be that the word " infinity " should not be applied to the Divine Nature without careful qualification. We certainly mean by God a Being whose goodness and power are without limit, but this must not be confused with the idea of infinite space or infinite time. There is a great difference between the assertion that all things depend upon God and the assertion that all things are God. The former assertion is a part of the Theistic view, the latter is not.

We are thus brought to the second of our main problems—that of creation. The relation of God to the world has been represented in many ways, of which the most important are identity, emanation, creation. As we have seen, the first of these is the conception which lies at the root of all Pantheistic philosophies in the proper meaning of that word. For the Pantheist the world and God are not two but one, they are the same Reality viewed from different standpoints. The difficulties of Pantheism have already been touched upon and we need not recur to them. Emanational theories have taken various forms, perhaps the most famous being that expounded by the last great philosopher of the ancient world—Plotinus. All theories of emanation turn upon the conception of grades of being, which proceed, not necessarily in time, from the Supreme Being, or the Absolute One, falling in value and reality as they are further removed from their Source. The essence of the emanation theory is that the world proceeds from God by a kind of necessity. It is the nature of the Divine thus to "overflow." The idea of creation is distinguished from that of emanation by the fact that it does not conceive the world as following by necessity from the Divine Nature, but as being produced by an act of will.

It is easy to exaggerate the importance of this difference between emanation and creation, for in fact the two ideas often approach one another. It need not follow from a theory of emanation that God is regarded as impersonal; and, on the other hand, it is often held by those who adopt creation as the best conception that to create is a necessity of God's nature as personal. Plainly the idea of creation lends itself to pictorial representation and has often been expressed in purely mythological terms. The analogy of the artisan making a piece of furniture, or the potter making his pots out of given material, has been taken as the guide to Divine Creativeness. The nature of the creative action of the Divine must be for ever obscure to us, and the most we can hope to attain is a point of view from which the creative action of God may be seen to be in line with something in our experience. It has been suggested by many philosophers that the work of the artist and the poet furnish us with the highest examples of finite creativeness, and hence are the most fruitful source of insight into the creativeness of God. Even this analogy, however, will take us but part of the way, and those who have made most use of it, as for example James Ward in his *Realm of Ends*, have confessed that it fails us at last.

Closely connected with the problem of creation is that of Divine Immanence.[1] The difference between Theistic and Pantheistic theories of the Divine Nature is often said to lie in the fact that Pantheism holds the Divine to be wholly immanent, while Theism holds that God is both immanent and transcendent. The statement is scarcely accurate, for any belief in immanence, if it is self-consistent, must imply transcendence. It is unmeaning to speak of immanence without, at the same time, implying that in which the Divine is immanent, and hence a distinction. As we have seen, the Pantheistic doctrine is the identity of God with the universe. The modern term immanence appears to mean much the same as the older " attribute of omnipresence." The idea of God cannot be associated with the idea of spatial limitation. That on which all things depend cannot itself be among the " things," and since space is the relation between things, or at least has no meaning apart from " things," we cannot think of God as occupying space. Consequently we cannot regard God as being present in any particular place to the exclusion of others, which is the same thing as saying that there is no place where God is not. There is, however, a difference between the ideas of omnipresence and immanence in this respect. Some writers would speak of degrees of immanence, but would hesitate to speak of degrees of Divine presence. The conception of immanence includes the idea of the manifestation of the Divine Nature. In this respect there are plainly degrees of immanence. Some aspects of creation must be supposed to be more complete disclosures of the nature of God than others. Thus, though we could not affirm that there is more of God in the human person than in the stone, we could justly assert that personality tells us more about the Creator than the stone. The doctrine of the Divine Transcendence is intended to guard against the danger of Pantheism. In the most general terms, it is the doctrine that the universe, if by that we mean the sum of finite existence, does not exhaustively display the being of God. He is beyond the greatest that we can conceive in point of power and the highest we can conceive in point of value. It should be noted, however, that the word " universe " is a very ambiguous term and should never be used without careful definition. Sometimes the word apparently implies the sum total of all that, in any sense whatever, exists, and in that case we could not affirm that God transcends the universe ; more frequently the word seems to mean a whole of finite existing things, and it is important to observe that one school of contemporary philosophers at least, the Italian Idealists, would deny that there is any such whole.

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[1] The term "immanence" (Lat., *in-maneo*) is used to express the presence and activity of God in nature and in the human mind. The term may be applied to other relations beside that of God and the world, in fact it is appropriate in any case of the association of two entities which are distinct from one another but not separate in space: e.g. the mind, or consciousness, may be said to be immanent in the body. Immanence is frequently contrasted with transcendence, but it is a mistake to suppose that the one excludes the other. On the contrary, immanence implies transcendence.

An important and controversial question concerning the relation of God with the world arises from the conception of God as the Perfect Being. According to the classical and mediæval theory on this subject, the perfect must be the absolutely self-sufficient, and therefore in need of nothing beyond itself. It has been concluded on this assumption that the created world is, in no sense, necessary to God, and even that its total annihilation would make no difference to His complete satisfaction. This conception is found in its extreme form in Aristotle, who held that God was not even aware of the existence of the world, and it has played a great part in orthodox Christian theology. In recent discussions of Theism a reaction is noticeable against this view, partly on the ground that such a conception of God would be hard to reconcile with the experience of religion, but also on metaphysical grounds. The controversy has been greatly confused by being mixed up with the question of the eternity of the world. The problem is not the same. Probably no Theist would hold that the present " physical universe " is eternal in its own right ; but it might nevertheless be held that some creation is a necessity. It is argued by those who take this view that creativeness is an essential characteristic of the Divine Personality, as it is, in an indefinitely lower degree, of human personality, and, further, that it is difficult to understand how the Divine Nature can be personal unless there is postulated a created order which stands to Him in the relation of " not-self " to self. The contentions of this school have been supported by the conclusions of Professor A. N. Whitehead who, approaching the problem from the standpoint of a philosophy of nature, has been led to postulate a God as necessary for the being of the world, and at the same time a world as necessary for the being of God. On the other hand, recent movements in German theology reinforce the opposite side in this controversy. The system of Karl Barth and, in some degree, that of Rudolph Otto emphasize the " otherness " of God and would not admit any relation of God with the world, or with man, which would compromise His absolute self-sufficiency. We must be content to note this important divergence of opinion here and observe that the two opposing views carry with them important consequences, practical as well as theoretical. On the first view, which lays stress on the Divine Immanence, there will follow naturally a religion which has affinities with Humanisn and seeks the Kingdom of God partly through the promotion of human progress ; on the second view, which lays stress on the absolute transcendence of God, there will be a disposition to despair of the world and of human progress, and to seek the Kingdom of God wholly in the unseen.

The dogmatic theology of our forefathers had much to say about the Divine Attributes, which were usually divided into two classes, the " metaphysical " and the " moral." Modern philosophy of religion, owing probably to its different approach, offers little systematic treatment of this subject. Indirectly, however, two topics which are part of the doctrine of the Divine Attributes have been discussed—the possibility of attributing moral goodness to God and the meaning of omnipotence. As we have seen, the conception of God is the conception not only of the Power on which all things depend, but of the Highest Value. God is the perfect Holiness. But obvious difficulties arise when we begin to think of God as morally good. Aristotle pointed out in the *Nicomachean Ethics* that it was absurd to think of a Divine Being as exercising moral virtues such as courage, or even justice, and concluded that the Divine activity could not be that of moral goodness, but must be that of pure intellectual contemplation. The difficulty which Aristotle stated has been recast by many modern idealist philosophers into a still more formidable objection. It is said that the moral life necessarily implies a limitation and the relation of the moral being with other selves of the same order. The moral life can exist only where there are ideals to be realized and a social intercourse between persons. On these grounds it has been held that, though God, or the Absolute, is the source of all moral values and, in the end, the goal of all moral endeavour, He is Himself " beyond good and evil " and not properly described as morally good. It must be admitted that the Holiness of God cannot be precisely analogous to the virtue of a good man, and if the Divine Holiness includes the virtue of courage, for example, we are unable to understand what transformation that virtue has undergone in the Divine Being. There is a possible view which seems to avoid this difficulty. It may be suggested that to think of goodness as consisting in the exercise of a certain number of virtues is misleading. The cardinal virtues are different aspects of goodness, but they all spring from one principle. They form a unity, because they are not independent qualities but convenient ways of describing the good life. This was Plato's conception of the virtues, and is the conception which is central in Christianity. According to the teaching of St. Paul, and indeed of the New Testament as a whole, "love is the fulfilling of the law," and every virtue is an activity of love. The attribution of love to God doubtless raises further problems, but it does not involve us in any contradiction. It may be that the conception of God as love will lead us to the further conception of distinctions within the Godhead, and furnish one of the speculative confirmations of the doctrine of the Trinity. The argument has been used by Christian theologians. Unitarians, on the other hand, would hold that the belief in the love of God does not necessarily lead to any trinitarian conclusion, since we can think of the Divine love as going forth to the creatures and finding its object in them alone.

The attribute of "omnipotence" has received more attention in recent discussions of the philosophy of religion than the other attributes because of its bearing upon the problem of evil. The crux of that problem is the apparent difficulty of reconciling the existence of evil with belief in a Creator who is at once love and omnipotent. That this old objection is still formidable is shown by the fact that so distinguished a philosopher as the late Dr. McTaggart has thought it worth while to dwell upon it in his *Dogmas of Religion*. James Ward and other writers have done valuable service in calling attention to the ambiguity of the word "omnipotent." In its original meaning, as used in the creeds, it signified "having power over all things" and was a statement of the ultimate dependence of all things upon God. In this sense it has religious value, and perhaps in this sense alone. A logical definition of omnipotence is not easy. It has been assumed by some that it includes the idea of power to do absolutely anything, including the contradictory. Thus the view has been held that God could make 2 plus 2=5. On the other hand, it has been contended that God can do all that He wills to do, but that He cannot will to do anything which contradicts His nature. It is pointed out that a mere arbitrary will is inconceivable and certainly not to be regarded as a perfection. God's will, then, must be the expression of His own nature, which is rational and good. Hence the will of God has a "formal" limitation since, being what He is, He cannot will the irrational or evil. But further, if we take the conception of creation seriously, we must recognize another limitation of the Divine power. The creation of free selves would be inconceivable unless we admitted that some limitation of the Divine power was possible. The limitation involved in creation would be a self-limitation, and not an inherent or necessary one.

The problem of evil upon which we have now touched is a standing difficulty for any philosophy of religion which is not simply destructive and critical. On any view of religion which does not regard it as pure illusion, the existence of evil must be an experience which requires consideration. This is true even if we do not adopt a Theistic interpretation of the world, for the type of thought which regards religion as belief in the " conservation of values " or the " ultimate reality of values " must find the reality of " negative values " a challenge and a perplexity. The discussion of this problem has a long history, and it cannot be said that modern thought has added much which is distinctively new. Perhaps it has become clearer that evil falls into three categories, which are not necessarily connected with each other, and are in fact capable of separate treatment. Sin, pain and error together comprise all that we call evil ; but it is obvious that the explanation of the existence of error may be quite different from that which is applicable in the case of suffering. Nevertheless the forms of evil are, in practice, often closely related, for some at least of human suffering is due to human wrong-doing and error, while sin again is partly the consequence of lack of insight into the nature of the good and the true condition of the given situation.

The theory that evil of every kind is the consequence of our finitude has been held by distinguished thinkers ; and on the assumption of an optimistic pantheism it would seem most logical to conclude that evil is real only from our limited standpoint, but from the point of view of the whole is a necessary element in its perfection. That some evils arise from our limitations is plain, but the assertion that there is nothing which is really evil is scarcely acceptable to most forms of religion and is difficult to reconcile with our experience. If there is nothing which is really evil, it is argued, the efforts of unselfish men to remove evil, and the promise of religion that we can be redeemed from evil, seem alike without justification. An opinion which has been of great importance in Christian thought is that evil is non-existent, in the sense that it has no positive being. Every evil, it is alleged, is a defect of being and not an existence. Hence we cannot attribute evil to the creative will of God, since not-being cannot be created. This doctrine, which was held by St. Augustine and Thomas Aquinas, cannot be said to have solved the problem of evil, for even if we allow that all evil is defect and non-being, we have still the question upon our hands, Why should the Creator have created a world in which defect was so rife ?

The idea which Augustine and Thomas adopted may be summed up in the phrase " anything exists in so far as it is good." In modern philosophy a closely related conception makes its appearance, adapted to the evolutionary mode of thought which is characteristic of the modern mind. It is one of the merits of Hegel to have emphasized the importance of " negativity " in development. Progress in a moving world occurs not in a steady upward movement, but by the overcoming of negation. Without the negation there would be no movement. This conception has been taken up by Idealists of the Italian School. The good, it is alleged, exists through the constant overcoming of its opposite. Thus truth is the continual transcending of error, and grows through the unceasing strife with imperfect and partly illusory ideas. Moral good exists only in the overcoming of moral evil. If there were no opposing movement there would be no such thing as virtue. We may allow a great measure of truth in these contentions, and agree that we cannot imagine a world in which goodness did not imply the possibility of its opposite and truth was not gained at the cost of the unremitting revision of concepts ; but it is not so easy to see what light is thrown by all this on the problem of suffering. In any case these abstract metaphysical arguments are, for most people, convincing rather than satisfying.

Leibniz is the one great philosopher who has devoted a large treatise to the problem of evil. His general answer to the question of why evil exists is that this is " the best of all possible worlds " and that any other world, though we may imagine in our ignorance that it would be better, would in fact include more evil and less good than that which actually exists. This sweeping assertion of the great optimist, and the system by which he supported it, would be accepted by few modern thinkers ; but an answer not fundamentally different has been given by more than one philosopher in recent times, among whom we may mention the late Sir Henry Jones. It is urged : look at the general features of the world and ask yourself whether, in your best moments, you would wish them altered. We cannot expect to see that every detail serves the purpose of a supreme good, but we can see that a world in which there were no hazards and hardships, in which every advance had not to be won, in which there was no adventure, would be a worse world than that in which we are. We should not wish to have everything given and no opportunity of struggle and victory. In other words, if the purpose, or part of the purpose, of the created order is the development of free personalities and the achievement by them of their own full stature through the pursuit of goodness, truth and beauty, then a world in its general structure such as ours is a requisite condition.

A paradox which has been pointed out by many writers must be mentioned here. The problem of evil, which may be called perhaps the great theoretical difficulty for a religious view of the world, is also a necessary factor in the emergence of the religious attitude. It is because men feel themselves to be weak and sinful and blind that they stretch out their hands towards a power, a perfection and a truth which will, as they hope, redeem them and raise them from their wretched state. When we reflect upon the mystery of evil we ought always to reflect upon the mystery of the Good towards which man aspires and which, as it appears, he cannot help believing to be already real.

The discussion of the problem of evil has raised the question whether suffering in any form can be held to enter the Divine Experience. Great difference of opinion on this respect has to be noticed in recent Theistic writers. It might have been expected that Christian thought, which is often said to be concentrated upon the figure of the Divine Sufferer, would have accepted the idea that suffering could be conceived as part of the life of God, while on the other hand, it might have been expected that the more pantheistic religions would have been hostile to the belief. Historically, however, this is not true. On the whole, the more philosophical Christian theology has held fast to the " impassibility " of God, to the conviction that the Divine Nature, as such, is incapable of suffering. The reason for this is that Christian thought in its orthodox forms has been deeply influenced by the Platonic and Aristotelian conception of the Divine Nature. It has assumed that God, being the perfect Being, must be absolutely complete and self-sufficient. Now suffering is always the result of a lack or want, and cannot therefore be attributed to One who is absolutely self-sufficing. The late Baron F. von Hügel, who adhered strongly to this view, maintained, in addition to this logical argument, that religion itself would fail of its consolation if it could not believe that God was raised above the possibility of pain. On the other side, it has been urged that the problem of evil becomes more pressing than ever if we thus remove God in our thought from all participation in our unhappiness, while it is, to some extent, relieved if we believe that He bears our griefs along with us. Christian thinkers have not failed to make the further point, that the appeal of the cross is due to the conviction that it reveals to us God suffering on our behalf.

The problem is not so easily resolved as exponents of either view have suggested, and though the balance of opinion appears to be against the older view of impassibility, it cannot be said that the difficulties in the opposite opinion have been removed. Even if we found some way out of the logical difficulty of self-sufficingness as a quality of the Perfect Being, we should still have to face another problem. It can be argued that the same reasons which might lead us to hold that God shares our suffering would equally lead us to hold that He shares our sin ; and this conclusion would be singularly inconvenient for any belief about God except Pantheism. If the expression of a personal opinion may be allowed, I would say that, on the one hand, it seems inconceivable that suffering does not enter, in some form, into the Divine Experience, for to deny that altogether would be to render unmeaning those assurances of the Divine sympathy which have given strength and peace to many religious souls. It would be to make God so transcendent that He would be quite different from what He is believed to be in the most poignant religious experience. On the other hand, however, it seems impossible to attribute mere suffering to the Divine Experience, for in that case we should fall into the error which Von Hügel dreaded, of debasing God in our thought to our own level of frequent frustration. The Divine Experience must be triumphant and therefore joyous ; but it may be that into it there enters the suffering of the world, real but overcome.

V

There are two topics which cannot be wholly omitted in a survey of the philosophy of religion—Immortality and Revelation. The religious view of the world includes not only the concept of the Divine but of man's relation with the Divine, and this relation has been expressed in the ideas that man's destiny is not circumscribed by the present life and that he has been the recipient of Divine communication.

The ideas of immortality and of a future life are not identical. The first implies an existence which is, in some way, raised above the vicissitudes of time, the second may mean no more than that there is another temporal existence for the individual following on death. The belief in a future life is almost universal in the more primitive religions, and it may justly be claimed that there is a wider consensus for it than for belief in God. Though the pictures of the future life vary in detail, there is one common principle pervading them. The uncivilized man thinks of his life in the beyond as an extension and reproduction of the present. Nor is the picture always of a life superior to the present one in happiness. On the contrary, beliefs are frequently of a melancholy character, and to the early Hebrew and Greek the lot of the departed was miserable compared with that of those still living. Religion does not, however, invariably give rise to a faith in personal survival. For a considerable period the higher religion of the Hebrews included no doctrine of individual immortality, but only that of the indestructibility of Israel, the chosen people of God.

When we turn to the religion of civilized men, it is important to observe that not every belief in survival of bodily death is a religious belief. The doctrine might be held as a mere fact, which could be supported by evidence but had no connexion with any spiritual end of human aspiration and no relation with worship. The belief in immortality becomes a part of the philosophy of religion when it is directly connected with belief in God.

Religious thought has been engaged for the past two centuries in a struggle with materialism, and with the more plausible surrogates for materialism which go under the name of " naturalism." The primary purpose of this struggle has been to vindicate the spiritual character of Reality and the right to believe in God; but the same warfare has been waged round the individual self and in connexion with the right to believe in his immortality. Here the difficulty for religious thought appeared more immediately pressing than in relation with belief in God, for it seemed clear that the human consciousness was dependent on the bodily organism, and every advance in physiology and psychology made this dependence more definite. There was thus apparent ground for the theory of T. H. Huxley and many Victorian philosophers that consciousness was a mere " epiphenomenon," a kind of temporary shadow cast by the brain. The development of reflection since the time of Huxley has brought into clear light the complexity of the problem of the relation of mind and body, and the fact that it constitutes one of the central enigmas of thought, hitherto an insoluble one. The Epiphenomenal theory has lost ground with serious thinkers and the prevailing views are forms either of Parallelism or Interactionism, i.e. that the two series, mental and physical, run on side by side without affecting each other, or that consciousness and the body act upon each other, neither being the creation of the other. To this development we must now add the consequences which seem to follow from the new departures in physical theory. So far as their general effect can be estimated, they lend support to the view that consciousness is fundamental in the universe and cannot be derived from or wholly dependent upon the material order. There is, we may suggest, a sharp change of direction in scientific thought. Whereas up to the end of the nineteenth century, on the whole, it lent support to the prejudice of common sense that consciousness is the product of matter, it tends now to support the opposite view.

The conceptions of immortality which have proved acceptable to religious philosophers fall roughly into two classes—inherent immortality and conditional immortality. According to the former, the human self is naturally immortal and imperishable; according to the latter it has no immortality in its own right but may attain immortality. The natural immortality of the soul was the doctrine which the Christian Church adopted and modified. The arguments of Plato, including the famous one based upon the soul's " simplicity," were all directed towards establishing the inherent immortality of the soul. Aristotle, though he did not accept the doctrine of individual immortality, held that the " creative reason " in man was Divine and imperishable. The anticipations of the Gospel in Plato were a favourite theme of the early defenders of Christianity, and it was natural that they should assume that the Platonic doctrine was, in essence, the same as the Christian belief in the resurrection of the body. Thus it has come about that the prevailing opinion in Christian theology has been that every rational self is immortal. Recently, however, the question has been asked whether the New Testament does in fact teach the natural immortality of all souls, and whether perhaps there is not a striking difference between the Platonic conception and that of primitive Christianity. The Philosophy of Religion is not concerned with the discussion of the historical question, but it must consider the meaning of the alternative view which, it is said, the New Testament presents.

The theory of conditional immortality may be summed up by saying that it takes literally the utterance of St. Paul, " the wages of sin is death, but the gift of God is eternal life." The immortality of the self depends upon the action and choice of the self. Those who definitely and irrevocably range themselves with the lower values, the things that perish, share the mortality of that which occupied their attention and their thought. They come to an end. Those who choose the higher values, the things that are eternal, receive the gift of immortality, " the wages of going on." It is implied in this second view that there is no conclusive reason for holding that every rational being is immortal. This, however, would be disputed by some philosophies at the present time. Dr. McTaggart may serve as an instance of the persistence of the belief that human immortality can be proved on metaphysical grounds.

Few contemporary thinkers would admit that the Platonic or any other arguments for immortality are conclusive, and there would be a large measure of agreement that belief in immortality must be based upon belief in God ; the best reason for holding it is that it is implied in the Theistic view of the world. Whether this is so or not is a matter of controversy ; but it may be contended that any religious, and certainly any Theistic, theory of the nature of Reality must hold that there is a " conservation of values." It would appear to be very difficult to hold both that all values are conserved and that all finite persons perish, for the values which we know are all intimately related with personal life, and, so far as we are aware, can have no existence divorced from personal experience. This consideration would support the conditional view of immortality if, as seems probable, there are some selves which do not attain that degree of development which would justify us in concluding that a rational universe, in the sense of one which produced and preserved the highest sum of value, would be one in which they must continue to be.

The idea of immortality involves a great number of subsidiary ideas which are not without obscurity. For example, the problem of personal identity is one which we should have to discuss in any complete treatment of the subject. Of still wider scope is the question whether the immortal life of those who have passed beyond death is a condition of progress towards a fulfilment, and whether the End towards which they aspire, the vision of God or the complete union with Him, is one which can be supposed to be compatible with individual existence in any sense. These discussions we must forbear to enter upon, but we must note that the fact that we may be able to find no satisfactory conclusion concerning them has little or no bearing on the validity of belief in immortality. Religion itself, when it has attained its highest point of spiritual insight, has refrained from any definite concept or image in this matter, and has been content to say, " Eye hath not seen, nor ear heard, neither hath it entered into the heart of man." We must repeat that there would be no value for spiritual religion in the conviction that life persists after bodily death, unless that life were the provision of new opportunities for the spirit in its quest for God.

All the great religions of the world, with the possible exception of Confucianism, profess to be founded upon a revelation. The record of the revelation is frequently contained in sacred writings, and the scriptures are themselves generally regarded as authoritative and as being part of the revelation. The primary source, however, of revelation is inspired persons ; in Christianity and Mohammedanism the revelation culminates in the person of the Founder of the religion, whose teaching is regarded as the highest source of the knowledge of God. The philosophy of religion is not concerned with the critical and historical enquiries which elucidate the origin of the written sources and the circumstances in which they were composed. But it is concerned with the general idea of revelation, with the possible meanings of the idea, and with the reasons which may be alleged for accepting a revelation as authentic. Revelation is an essential conception for religion. There is no living religion which is, in its own view, the mere product of human reflection ; all rest upon the supposed self-disclosure of the Divine. Nor can the most enlightened Theism dispense with the belief, since it would be a strange paradox to believe in God and, at the same time, to hold that He had in no way disclosed Himself to His creatures.

Religious thought has been haunted by the distinction between reason and revelation. Sometimes these have been set in opposition to one another, but more frequently they have been regarded as separate but co-ordinate sources of Divine knowledge. The theology of the Middle Ages in Christendom spent much thought upon the relation of the authority of Revelation and the power of the unaided human reason. The differentiation between " natural " and " revealed " religion is still common. As we have already seen, according to Thomas Aquinas certain truths concerning God, such as His existence and His unity, are open to the mind of man apart from any revelation. They can be demonstrated by the speculative intellect : they have in fact been demonstrated by Aristotle. Certain other truths, such as the Incarnation, the Redemption of man, the creation of the world, and the Trinity could not have been discovered by human reason. Now that they are authoritatively revealed they can be shown to be not contrary to reason, though above it. Certain consequences follow from this theory. In the first place, it seems that the substance of revelation is the same in kind as that of the knowledge which the intellect acquires by its own independent operation. Revelation, so to speak, steps in where reason leaves off, and supplements man's imperfect supply of truth about God with more truth about God. We should observe, however, that Aquinas recognizes another function in Revelation. It conveys the truths of " natural religion " to those who, from lack of faculty or opportunity, would not otherwise have known them. A conception practically identical with this was adopted by Bishop Butler, according to whom a part of the office of Revelation is to be a " republication of natural religion." In the second place, a consequence concerning the credentials of revelation must be pointed out. Since the essential nature of revelation is to add to what reason can tell us, the evidence of revelation cannot be its conformity to reason. Our ground for accepting it must be sought in " external evidence," in miracle and the fulfilment of prophecy.

Various causes have been at work to produce a movement away from this position in modern thought. The fact that the value of alleged miracles as evidence of revelation has been disputed, and the new critical conclusions concerning the nature of prophecy, have played an important part ; but perhaps of even greater influence have been considerations drawn from the nature of religion itself and the study of the relation of authority to reason. The old division between natural and revealed religion has been questioned by many writers, notably by Professor Clement Webb, and the increasing knowledge of the phenomena of religious experience has reinforced the disposition to abandon the traditional standpoint. No part of the philosophy of religion has been so little investigated as the idea of revelation, and it must be confessed that we await a systematic treatment of the question. The main lines, however, of a modern view are taking shape. It would discard the assumption that the primary content of revelation is " propositional " knowledge, a collection of miraculously communicated statements about Divine things, or supernaturally imparted philosophy. It would return to the Biblical conception of revelation as the self-disclosure of God in human experience, in the lives of persons. The theological doctrines, and the literary expressions of this experience, are not themselves the revelation but are more or less adequate interpretations of it. In this way it would be impossible to divide religion into " natural " and " revealed," for all religion would be revealed, and at the same time all would be a proper object of rational criticism and valuation.

If this theory were adopted, it would be necessary to extend the notion of revelation beyond the borders of religion in its narrower sense and include all apprehension of spiritual values, moral and æsthetic as well as " religious," within its scope. The fact that much religion is mixed with superstition and positive evil would be explained on the ground that revelation, being always through persons, must be conditioned by the capacity of the persons ; the human element in the revelation will always be present. The Divine light will always be distorted by the human medium ; in One alone, according to Christian belief, has the human personality been the adequate instrument of the Divine self-revelation.

In this manner we might conceive the whole spiritual development of man as a revelation of God, and might proceed to trace the line which seemed to lead most directly to revelation's highest point. Some such argument would be used by a modern believer in a special and final revelation to justify his belief that there has appeared in history a disclosure of the Divine which has supreme authority. Into these domains it is scarcely the duty of the philosophy of religion to enter. It has fulfilled its task when it has taken us to their boundary and pointed to the territory which remains for the enquiring spirit to explore.

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THE PHYSICAL NATURE OF THE UNIVERSE

By

J. W. N. SULLIVAN

SYNOPSIS

This Article begins with the fundamental physical concepts introduced into science in the seventeenth century and describes their successful application to a description of a variety of phenomena. The discovery that these concepts were inadequate is then shown to have been brought about by the fruitless attempts to construct a mechanical theory of light, and by the experimental work that led to the dissociation of the atom into charges of electricity. Cognate discoveries, e.g. Radio-activity and X-rays, are also mentioned, and the electric theory of matter is developed. Further analysis of matter is shown to make a still more fundamental revision of scientific concepts necessary, and the reader is introduced to the modern Quantum Theory and to the new theories of atomic structure. It is shown that science has abandoned the ideal of explaining phenomena in terms of the *familiar*. The abstract character of the new theories is emphasised. The simultaneous analysis of space and time conceptions, culminating in the generalised Theory of Relativity, is also described, and an account is given of the Theory of the Finite Universe and of the recent attempts to extend still further the range of Relativity Theory.

THE PHYSICAL NATURE OF THE UNIVERSE

§ 1

The science of Physics has often been presented to an admiring world as the ideal science. It seems to fulfil all the criteria that make an enquiry truly scientific. Thus it rests upon observation and experiment; all its terms are clearly and exhaustively defined; and it reaches its conclusions by the impeccable method of strict mathematical reasoning. Compared with it all other sciences are, in one respect or another, imperfect. Thus astronomy, although it rests upon observation and employs mathematical reasoning, knows nothing of experiment. Men cannot experiment with the stars. The astronomer cannot handle and control his material with the facility that the physicist enjoys. The science of chemistry, although most firmly rooted in observation and experiment, makes comparatively little use of mathematical reasoning, and some of its fundamental concepts are not yet, perhaps, entirely free from obscurity. Biology is still more imperfect in these respects, while to call psychology, ethnology, economics, and so on, scientific is to express an aspiration rather than an achievement.

It would seem, therefore, that the best exhibition of the procedure of science and of its ultimate aim is to be found in the science of physics. Physics, one would suppose, is the study which presents the scientific method in all its purity. But when we study the descriptions of the various phenomena covered by the science of physics we do not find that any one ideal of " explanation " has been consistently adopted. Different kinds of explanations have been fashionable at different times. It would seem, on a broad survey of physics, that science does not yet know its own mind. Einstein's theory differs from Newton's not only in mapping more accurately the region of phenomena surveyed, but also in the fact that the map is constructed on entirely different principles. The atom of modern physical theory is not only a more complicated entity than the atom of the Victorians, but it is, as an intellectual construction, based on entirely different concepts. Physics began, and for a long time continued its career, by trying to explain phenomena in terms of familiar notions. Thus Newton's " forces " of attraction and repulsion had their psychological origin in our sensations of muscular effort—of pulling and pushing. The " electricity " of the early physicists was conceived as a " fluid." The " atom " of the Victorians was analogous to a tiny grain of sand. Modern physics has given up this criterion of familiarity. Many modern physical theories consist in establishing mathematical relations between entities which can be logically defined but which are quite unimaginable. It is for that reason that these modern theories cannot be " pictured."

Although physics has, in very important respects, profoundly changed, it remains mathematical in character. The primary entities used in physics are all capable of mathematical definition. Indeed, entities which cannot be defined mathematically would not be adopted in physics. We may say that physics is an adventure. It is an attempt to describe Nature, or certain parts of Nature, mathematically. In this respect the science of physics has always been self-consistent. But the primary entities to which the mathematical method is applied have changed out of all recognition of recent years. In that sense the science of physics has truly undergone a revolution. To understand this revolution we must understand the causes that have brought it about.

§ 2

Modern physical science is popularly supposed to have begun with Galileo. Scholars can show that there was considerable activity, of a kind that we should have to call scientific, before Galileo, but it remains true that Galileo was the first to isolate clearly certain fundamental scientific ideas, and the first to present them forcibly to the mind of his time. Galileo's greatest contribution to the scientific outlook consists in his analysis of the notion of motion. He claims to have been the first to realise that motion should be treated mathematically. Even so simple a matter as the acceleration of a falling body had never been stated clearly before. People realised, of course, that a falling stone moves faster and faster, but it does not seem to have occurred to them to measure the rate of increase of the motion. Galileo understood this perfectly. As he says : " It is requisite to know according to what proportion such an acceleration is made ; a problem that I believe was never understood hitherto by any philosopher or mathematician, although philosophers, and particularly the peripatetics, have writ great and entire volumes touching motion."

How did Galileo come to conceive the idea of treating motion mathematically ? How, in fact, did the notion ever arise that Nature is a vast mathematical machine ? The notion was not a part of the orthodox Aristotelianism of the Middle Ages, although it had occurred to certain exceptional minds, such as Roger Bacon and Leonardo da Vinci. It seems, as a matter of historical fact, that the notion came about as a result of certain philosophical speculations. There has always been a certain type of mind which is prone to find in mathematics the key to all things. Some of the manifestations of this general attitude are decidedly puerile, as we see when numerical interpretations are applied to the prophetic books of the Bible. The Great Pyramid imbecilities and some of the Shakespeare-Bacon controversies are manifestations of the same tendency. Even some very great men have been impressed by the mystical significance of mathematics. Thus, St. Augustine tells us that God created the world in six days, because six is the perfect number (being the sum and also the product of the first three numbers), and six would still be perfect even if the work of the six days did not exist. We may dismiss these notions as mere fantasies, but it cannot be denied that the general attitude played a great part in the creation of science. Kepler, one of the really great creators, thought that Nature is essentially mathematical. He did not merely believe that phenomena could be described mathematically; he believed that the cause of the phenomena existing at all was that they fulfilled certain mathematical relations. Galileo did not go quite so far as this, but he did not always feel it necessary (he tells us) to verify his mathematical deductions by experiment. We realise now, of course, that a mathematical deduction must always be checked by experiment. This is not because mathematical reasoning is in itself imperfect, but because the premises from which we start may not correspond precisely to the facts. Newton recognised perfectly the issues involved when he said that the attempt to describe Nature mathematically is an adventure which may or may not be successful. If it breaks down (he said), we must try another method. The method has, as a matter of history, been enormously successful, but we must not assume that Nature is necessarily a mathematical machine, although it is quite likely that we shall be unable to understand it if it is not.

Galileo, as we have said, was the first to make the notion of motion clear and precise enough to be treated by mathematical methods. In doing so he also had to make a precise mathematical concept out of the notion of Time. It was his grasp of the mathematical nature of time (as a uniform flow) that led him to devise more accurate clocks.

Galileo believed that the really important properties of the world are those that can be mathematically defined. Thus, things differ from one another in size, shape, weight and motion, and all these four properties can be described mathematically. The whole world was built up, he believed, out of atoms, and these atoms had the four properties mentioned. Differences of motion are produced by *force*, but Galileo does not tell us what force is. He leaves the notion of force something of a mystery. His conclusion is that atoms, acted on by forces, produce, by their combinations, the whole material universe. And in this conclusion we have presented, in essence, the problem that was to dominate physics for nearly two hundred years. We may say, roughly, that the science of physics came about as an attempt to solve one great problem—to show that everything is explainable in terms of the motions of little particles. In these terms there had to be explained the different states of matter—solid, liquid, gas. There had to be explained the phenomena of heat, light, sound, magnetism and electricity, and a host of other phenomena, besides the great omnipresent fact of gravitation. As we shall see, the effort has been partly successful and has, in part, been definitely abandoned.

§ 3

The scientific adventure began, as we have seen, by assuming that the only properties possessed by the real world are such properties as size, shape, weight and motion—all of which can be described mathematically; that is to say, they are all quantitative properties. But we are aware of aspects of the world that are not obviously quantitative. We are aware, for instance, of colours, sounds, odours. What do these perceptions tell us about the real world? This question really belongs to philosophy, and different philosophers have given different answers to it. But science has generally assumed that these non-quantitative properties are not part of the real, objective world. The point of view is well put by Galileo, who was the first to make it explicit. He says :

> " But first I want to propose some examination of that which we call heat, whose generally accepted notion comes very far from the truth if my serious doubts be correct, inasmuch as it is supposed to be a true accident, affection and quality really residing in the thing which we perceive to be heated. Nevertheless, I say that indeed I feel myself impelled by the necessity, as soon as I conceive a piece of matter or corporeal substance, of conceiving that in its own nature it is bounded and figured in such and such a figure ; that in relation to others it is large or small ; that it is in this or that place, in this or that time ; that it is in motion or remains at rest ; that it touches or does not touch another body ; that it is single, few, or many ; in short by no imagination can a body be separated from such conditions : but that it must be white or red, bitter or sweet, sounding or mute, of a pleasant or unpleasant odour, I do not perceive my mind forced to acknowledge it necessarily accompanied by such conditions ; so if the senses were not the escorts, perhaps the reason or the imagination by itself would never have arrived at them. Hence, I think that these tastes, odours, colours, etc., on the side of the object in which they seem to exist, are nothing else than mere names, but hold their residence solely in the sensitive body ; so that if the animal were removed, every such quality would be abolished and annihilated. Nevertheless, as soon as we have imposed names on them, particular and different from those of the other primary and real properties, we induce ourselves to believe that they also exist just as truly and really as the latter. I think that by an illustration I can explain my meaning more clearly. I pass a hand, first over a marble statue, then over a living man. Concerning all the effects which come from the hand, as regards the hand itself, they are the same whether on the one or on the other object—that is, these primary properties, namely, motion and touch—but the animate body which suffers that operation feels various affections according to the different parts touched, and if the sole of the foot, the kneecap, or the armpit be touched, it perceives, besides the common sense of touch, another affection, to which we have given a particular name, calling it ' tickling.' Now this affection is all ours and does not belong to the hand at all. And it seems to me that they would greatly err who should say that the hand, besides motion and touch, possessed in itself another faculty different from those—namely, the tickling faculty ; so that tickling would be a property that exists in it. A piece of paper, or a feather, lightly rubbed on whatever part of our body you wish, performs, as regards itself, everywhere the same operation—that is, movement and touch ; but in us, if touched between the eyes, on the nose and under the nostrils, it excites an almost intolerable tickling, though elsewhere it can hardly be felt at all. Now this tickling is all in us and not in the feather, and if the animate and sensitive body be removed, it is nothing more than a mere name. Of precisely a similar and not greater existence do I believe these various qualities to be possessed, which are attributed to natural bodies, such as tastes, odours, colours and others.

> But that external bodies, to excite in us these tastes, these odours, and these sounds, demand other than size, figure, number and slow or rapid motion, I do not believe ; and I judge that, if the ears, the tongue and the nostrils were taken away, the figure, the numbers and the motions would, indeed, remain, but not the odours, nor the tastes, nor the sounds, which, without the living animal, I do not believe are anything else than names, just as tickling is precisely nothing but a name if the armpit and the nasal membrane be removed."

Thus, Galileo maintains that the characteristics of the real world are quantitative, and that our perceptions of qualitative differences are merely the way our minds react to certain quantitative differences. Thus, colours, as such, do not enter into the scientific scheme. Light is a wave-motion in the ether, and different colours correspond to different wave-lengths. It is the wave-length with which science is concerned. It is for this reason that a colour-blind man, or a man born blind, can understand perfectly the whole science of optics.

It is to be noted that in this passage Galileo assumes rather than proves that perceptions of weight, motion, etc., are of an altogether different kind from our perceptions of colour, sound, etc. He assumes that the first class of perceptions reveal to us an objective reality, whereas the second class does not. He imagines that weight, motion, etc., would still exist "without the living animal." This is an assumption with which many philosophers disagree. The distinction is important, however, as making clear the limits within which science is confined by its method. Science is confined to the quantitative features of the world, but there is no real reason to suppose that everything science neglects is less real than what it accepts.

§ 4

Although the theory that matter is composed of small indivisible particles was not given precise shape until the nineteenth century, the atomic theory, in a more or less vague form, had been held by many scientific men from the time of Galileo onwards. But the first man to make the theory quantitative, and therefore a valuable instrument in research, was Dalton, who applied it with considerable success to the phenomena of chemistry, thus giving that science a quantitative basis it had hitherto lacked.

Until quite recent times the atom was conceived as a small, hard and probably spherical piece of matter. The word "atom" is properly applied only to the ultimate particles of a chemical element. The ultimate particle of a chemical compound which is, of course, formed of the combination of two or more elements, is properly termed a "molecule." There are about ninety distinct chemical elements in the world, and every other substance is formed out of combinations of two or more of them. Thus, sodium is a chemical element and so is chlorine. But sodium chloride, which is common table salt, is a combination of sodium and chlorine. Water is a combination of hydrogen and oxygen. An ultimate particle of water—a molecule—consists of two atoms of hydrogen united with one atom of oxygen. For the purpose of understanding these, and similar facts of chemistry it is not necessary to conceive the atom as being anything more than a small particle, analogous to a very tiny grain of sand. It is not necessary to attribute *structure* to the atom. Also, as we shall see, this simple conception suffices to explain many physical phenomena. It is only certain recent researches which make it necessary for us to regard the atom as an extremely complicated structure.

The three states of matter—solid, liquid, gaseous—are readily explained on the basis of the atomic theory. In a solid we may regard the atoms as being fixed in position. They may be able to vibrate about these fixed positions, but they have very little freedom to wander about. For this reason a solid preserves its shape. In a liquid the atoms have more freedom of movement ; they can slide about over one another. Hence a liquid easily takes the shape of any vessel into which it is put. Nevertheless, the atoms of a liquid are sufficiently closely bound together to ensure that the liquid shall remain of the same *volume* into whatever vessel it may be put. In a gas, however, the atoms have achieved their maximum degree of freedom. A gas consists of a number of atoms, or molecules, flying about in all directions with all velocities. There is no natural limit either to the size or the shape of a gas. A gas simply expands until it fills whatever vessel contains it. Thus, the differences, in broad outline, of the three states of matter are readily explained by the atomic theory.

The agent that brings about the change from the solid to the liquid and from the liquid to the gaseous is heat. It follows, on this theory, that heat increases the atomic and molecular motions of bodies. It is easy to go further and to assume that heat actually consists of these motions. This theory, which is now the accepted theory, was probably held by Galileo, and was certainly held by Newton, Hooke, Boyle and others. But during the eighteenth century this theory—that heat is a mode of motion—fell into disrepute, and was replaced by the *caloric* theory of heat. According to this theory, heat is a fluid, called " caloric," whose union with bodies raises their temperature. This theory was always unsatisfactory. It was so unsatisfactory, in fact, that men of science were always tinkering with it in order to meet various objections. Thus, the original form of the caloric theory explained the fact that bodies expand on being heated by saying that the particles of caloric that enter into the body repel one another and thus stretch the body out. But it was pointed out that the expansion rule was not universal. Thus, water expands on *freezing*. How is this to be explained ? The calorists explained it by modifying their original assumption. They now said that caloric combines *chemically* with the body. Now the volume that results from a chemical combination cannot be predicted. Thus the calorists got out of the difficulty by saying that anything might happen. This is unsatisfactory. A scientific theory that only lives by undergoing successive arbitrary modifications must be regarded with suspicion.

But the death-blow to the caloric theory was given by Count Rumford in 1798. While engaged in boring brass cannon at the military arsenal at Munich, he found that the metallic chips thrown off were very hot. This heat was obviously produced by friction, and he undertook experiments to find out whether there was any limit to the amount of heat that could be produced in this way. He found no limit. It appeared that heat could be generated by friction inexhaustibly. This result was sufficient to disprove the caloric theory. As Rumford said : " Anything which any *insulated* body or system of bodies can continue to furnish without *limitation* cannot possibly be a *material substance*." The only thing that can be generated indefinitely in this way, Rumford concluded, is motion. He decided, therefore, that heat is a mode of motion. Numerous other experiments confirmed this conclusion, and it is now universally accepted that the heat of a body is due to the motion of its constituent molecules.

A very interesting result can be deduced from this theory. If heat is a manifestation of the molecular motions of a body, it follows that, if the molecular motions cease, the body possesses no heat at all. We are accustomed to suppose that a body can get colder and colder, just as it can get hotter and hotter. But if heat depends on molecular motions, then, in the absence of those motions, there can be no heat. A body in this state is said to be at the absolute zero of temperature. This temperature, it can be shown, is the same for all bodies, and theoretical considerations enable us to say what this temperature is. Measured on the centigrade scale, the absolute zero is 273° below zero, the ordinary centigrade zero being, of course, the temperature of melting ice. Thus, the absolute zero of temperature is 273° below the temperature of melting ice, or 373° below the temperature of boiling water, since water boils at 100° on the centigrade scale. The absolute zero of temperature can be very nearly attained by modern laboratory methods. Temperatures of about one degree above the absolute zero have been reached. At such temperatures all known gases become solid, as we should expect, since their molecular motions have almost entirely ceased.

The range of temperature in the universe extends from the absolute zero to the temperature of the central portions of the stars. This latter temperature is estimated to be many millions of degrees. The great bulk of the matter in the universe is, from our point of view, exceedingly hot. It is only the very cold parts of the universe, those where the temperature is very near to the absolute zero, that can support life.

The fact that the molecules of a body are normally in movement can be demonstrated by what is called " The Brownian Movement." In the year 1827 an English botanist named Brown observed that very small particles suspended in water were in a state of constant agitation. For many years this discovery attracted no particular attention ; it was put down to inequalities of temperature or to vibration. But a series of careful experiments finally showed that the effect really was remarkable and could not be accounted for by any ordinary means. The explanation was given by Einstein. He showed that the phenomenon was produced by the molecular movements of the water. The small particles, suspended in the water, must be perpetually struck by the moving molecules of water. As the molecules move indiscriminately in all directions, these collisions would usually cancel out. But it would sometimes happen that more molecules would strike the particle on one side than on another, and thus knock the particle a little forward. The next instant the direction of maximum impact would be changed. And thus we should obtain the incessant and highly irregular movements noticed by Brown. When Einstein's theory was experimentally checked, it was found to be fully confirmed. Thus, we may say that the Brownian Movement is a direct revelation of molecular movements.

Further support to the doctrine of molecular movements is given by the success of the Kinetic Theory of Gases. According to this theory a gas consists of a number of molecules flying about in all directions. As the temperature of the gas increases, the velocities of the molecules increase. On the basis of this theory the properties of gases can be worked out and are found to be in accordance with the experimental evidence. Here is another proof, therefore, of the truth of molecular motions.

§ 5

We have seen that the notion that matter is composed of small ultimate particles is sufficient to explain a fair range of phenomena. But, in the course of these explanations, the notion of the atom has not been made very precise. It has not been necessary to make it so. It has been sufficient to imagine the atom, vaguely, as a small, hard and possibly spherical body. But this small body has been supposed to be of uniform constitution throughout. We have not supposed that it possessed a *structure*. A whole new realm of thought, which science cannot yet fully survey, was thrown open when it was found that this simple conception was inadequate.

The first indication that atoms were not the simple things they had been taken to be came with the discovery of the Periodic Table of the Elements. Atoms, it must be remembered, were known to be of different weights. All atoms of the same element were of the same weight, but the atoms of different elements differed in their weights. The chemists, by laborious and accurate experiments, had determined the relative weights of different kinds of atoms. Thus, it was known that an atom of oxygen weighed sixteen times as much as an atom of hydrogen. The elements could be arranged in the order of their atomic weights, beginning with hydrogen, the lightest of the elements, and ending with uranium, the heaviest known element. When the elements were arranged in this way it was found that they fell into more or less well-defined groups. A group of heavy atoms would be found to repeat, fairly closely, the chemical and physical properties of a group of lighter atoms. This sort of repetition ran all through the table. At regular intervals atoms appeared which seemed to be, judging from their properties, more complicated versions of atoms which had appeared earlier in the table. The physical and chemical properties that characterised any given atom occurred periodically at intervals throughout the table. This similarity of properties suggested a similarity of structure. It began to be suspected that atoms were not merely simple particles, but entities possessed of a more or less complicated structure. Another twenty-five years was to elapse, however, before this surmise received experimental justification.

Between the years 1895 and 1900 a series of extraordinary experiments showed definitely that the atom is not a simple entity. The first group of these experiments was concerned with the electric discharge in a vacuum tube. If two metallic plates are fixed inside the two ends of a glass tube which has been exhausted of air and these two plates are then connected to a source of electricity, a somewhat complex phenomenon occurs in the tube. The chief part of the phenomenon, however, consists in a stream of something coming from the negatively electrified metal plate. It can be shown that this stream travels in straight lines, for if an obstacle be placed in its path a clearly-defined shadow is thrown on the far end of the glass tube. If a magnet be brought near the tube, the direction of the stream is deflected. It was proved that the rays constituting the stream actually carry negative electricity with them and, further, that they possess the extraordinary property of being able to pass through thin sheets of metal. In 1897 J. J. Thomson put forward the theory that these rays consisted of electrically charged particles, but that the particles, as their penetrative power proved, were much smaller than ordinary atoms. The next step was to determine the precise size of these little particles. This was done, with the extraordinary result that they were found to be nearly two thousand times smaller than the lightest known atom—namely, the hydrogen atom. These little electrified particles were called " electrons." Further experiments showed that, wherever and however they were obtained, all electrons were exactly alike. Here, then, it was conjectured, were the real foundation-stones of the material universe. The theory came into being that all material atoms are composed of electrons.

But in the meantime a very interesting discovery had been made respecting the nature of these electrons. We have described them as " electrified particles." Now J. J. Thomson had shown, some years before, that when a body is charged with electricity, that body behaves as if its mass were increased. It is as if the electric charge has a mass of its own. How much of the mass of an electron is due to its electric charge? This question could not be answered until the mass and the electric charge of an electron could be measured separately. This was finally done and the result was bewildering. It turned out that the *whole* of the mass of an electron was due to its electric charge! The electron was nothing but electricity. There was no " ordinary matter " there at all. The theory that matter is composed of electrons, therefore, really meant that matter is built up out of " disembodied charges of electricity." The theory seemed to make the whole world of matter completely unsubstantial. The theory could only be assimilated by making our notion of " matter " somewhat more abstract. We had to get rid of the notion of " substance " and replace it by the notion of " behaviour." Anything that behaved like matter, anything, in particular, that manifested the cardinal property of matter—namely, inertia—was fitted to play the rôle of matter. Electrons possess all the necessary properties. The fact that they are called " electric charges " instead of " material particles," only means that they possess other properties in addition.

It is evident, however, that electrons, by themselves, are not sufficient to build up atoms of matter. Atoms are electrically neutral, whereas every electron is charged with negative electricity. Further, electrons, all being negatively electrified, repel one another and an assemblage of them could not be stable. We must assume, therefore, that the electrons in an atom are somehow associated with a charge of positive electricity. Such a combination could be stable, and would also account for the fact that an atom is electrically neutral.[1]

The next step was to determine the way in which these constituents are arranged in the atom. After one or two unsuccessful attempts had been made, Sir Ernest Rutherford suggested an arrangement which has had a great measure of success. This was the famous theory of the atom as resembling a "miniature solar system." The positive charge was supposed to be located at the centre of the atom, while the negative electrons, like so many planets, circulated round it. In every case the central positive charge is just sufficient to counterbalance, electrically, the sum of the electrons circulating round it. The differences between different kinds of atoms were explained by differences in structure. Thus, a hydrogen atom consists of a positively charged nucleus with one electron circulating round it. The next atom in the table of the elements—helium—has two circulating electrons. The next atom has three, and so on, until we reach uranium, which has ninety-two circulating electrons.

Such is, in broad outline, Rutherford's theory of the atom, although, when worked out in detail, various complications arise. Thus, it was found that the positively charged nucleus must be given a complex structure, except in the case of the hydrogen atom. The nucleus of the hydrogen atom is taken as the unit of positive charge, and is called a "proton." The nucleus of the helium atom, however, does not consist of two protons, but of four protons combined in some way with two electrons. The nuclei of other atoms are still more complicated. Also, the orbits of the circulating electrons in an atom cannot be assumed to be simple circles. Some of them are very markedly elliptical. Further, they do not all lie in the same plane.

This model of the atom, although well confirmed by experiment, was not at all satisfactory to the mathematicians. According to the accepted laws of electrodynamics, which had been thoroughly well confirmed over a wide range of phenomena, such an atom could not be stable. The revolving electrons, it could be shown by mathematical calculations based on the accepted laws, would necessarily radiate energy and approach ever more closely to the nucleus. Finally, they would fall into the nucleus and the whole atom would vanish in a flash of radiation. On the basis of the accepted laws of nature, therefore, such an atom was impossible. It so happened, however, that a new and very strange theory of radiation had been proposed by Max Planck some years before. He had come to the conclusion that the heat radiated from a hot body was not radiated in a continuous manner, but in little jerks, or *quanta*. Similarly, the heat falling on a body was not absorbed continuously. Planck imagined that this curious effect was due to some sort of resonating apparatus in the atoms of bodies, but later developments of the theory showed that the effect was not brought about in that way at all, but was a revelation of the actual nature of radiant energy. Radiant energy is, in its very nature, atomic. This conclusion applies to all forms of radiant energy—heat, light, electricity, X-rays and so on.

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[1] If a piece of glass be rubbed by a piece of vulcanised india-rubber a certain degree of force is required to separate them and, if not too far apart, they are found to attract one another. They have been electrified by friction. In general, any two bodies can be made to exhibit the same phenomena. But it will be found that one of these bodies will repel the glass and attract the rubber, and that the other will repel the rubber and attract the glass. Hence there are two kinds of electricity. They are called positive and negative. Like charges (*i.e.* both positive or negative) repel one another. Unlike charges attract one another.

It occurred to a brilliant young Danish physicist, Niels Bohr, that this theory, with certain modifications, could be applied to the atom. The application turned out to be very successful. It not only accounted for the stability of the atom, but it also accounted for certain well-known experimental results which had never previously been explained. In making this application it was necessary, of course, entirely to abandon the old laws of radiation. It might be thought that this was merely an instance of the ordinary process of scientific advancement—merely the replacing of an old theory by a new and more comprehensive theory. But the curious and disconcerting fact is that the old theory of radiation cannot be completely abandoned. According to the old theory, radiant energy spreads out from its source in the form of waves. According to the new theory—the Quantum Theory—it spreads out like a flight of bullets. The two theories cannot be reconciled with one another, and yet there is very strong experimental evidence for both. Certain of the phenomena connected with the propagation of light have not yet been explained by the quantum theory, whereas the old wave-theory of radiation explains them perfectly well. On the other hand, there is a large class of phenomena, such as the liberation of electrons from metals under the impact of X-rays, that seems to be explainable only on the principles of the quantum theory. Amongst these phenomena we must include the processes that go on inside an atom.

The account we have so far given of the atom is more or less picturable. We have presented the electron as being something like a very small particle moving at a determinate speed round orbits of a determinate shape. This picturability is, however, largely illusory, as we find if we examine the picture in more detail. There is no need to make this examination, however, for every picturable element in the theory has now been given up.

The theory of the atom that we have outlined was first found to be seriously insufficient in 1925, and since that date an entirely different theory has been developed. This theory is, however, purely mathematical. The fundamental entities assumed by it are no longer picturable at all. The electron, for instance, on this theory is described not as a particle but as a system of waves. These waves are located within what is called a "configuration space." This configuration space is certainly not ordinary physical space, for the reason that each electron requires a three-dimensional configuration space to itself. Thus, two electrons require a space of six dimensions in which to exist; three electrons require a nine-dimensional space; and so on. It is evident, therefore, that the configuration space is not real space, and in this sense the wave system that represents an electron is a mere mathematical device and not a description of a physical reality. The justification of the theory is that it leads to calculated results which are confirmed by experiment. These results cannot be deduced from the older theory.

Since the resolution of an electron into waves seems to be merely a mathematical device, it is distinctly baffling to find that there is experimental evidence for it. A number of experiments on the refraction and reflection of electrons show that they behave like waves. No satisfactory interpretation of these results has yet been given. They can hardly be taken as confirmatory of the mathematical theory, for that theory is not concerned with physical waves. And yet it is difficult to suppose that such results are entirely unconnected with the theory. All that we are justified in saying is that the mathematical analysis of an electron into waves does correspond to certain essential characteristics of the electron, but precisely how far that correspondence extends is a matter for future investigation. In the meantime it is safest to assume that all we know about the electron is its mathematical specification, and that we are not yet in a position to say what is the physical reality that obeys that specification.

The general theory of the atom as a structure of protons and electrons receives striking experimental confirmation from the phenomena of radio-activity. Radium, as is well known, shoots out two kinds of particles, called α-particles and β-particles. The nature of these particles is known. The β-particles are simple electrons. The α-particles are much more massive and much more complicated. An α-particle is, indeed, identical with the nucleus of a helium atom which, as we have already seen, is composed of four protons united with two electrons. Both α and β particles are shot out from the highly complicated nucleus of the radium atom. They testify to the actual disintegration of this atom. Each step in the disintegration of a radio-active substance (of which about forty are known) changes it into another element. Thus, radium passes through a whole series of transformations until it finally settles down as lead. The phenomenon of radio-activity is one proof, amongst many, that atoms are complex structures.

We have seen that the atomic theory of matter has changed out of all recognition since the days of Galileo. The scientific notion of matter has become steadily more and more abstract, until at present science can tell us nothing about it but its mathematical specification. The old familiar conception of an enduring substance has been replaced by a collection of mathematical symbols. We shall find that this process of abstraction is typical of modern physics.

§ 6

Besides the problem of the constitution of matter, the science of physics was early concerned with the nature of certain " influences," such as heat, light, sound, magnetism and electricity. Heat, as we have seen, was explained as the motion of little particles, and it was suspected that the other influences would turn out to be explicable as motions of some medium or other. In the case of sound the explanation was speedily forthcoming. Sound, it was shown, was due to waves set up in the air by a vibrating body. The waves travel through the air as alternate pulses of condensation and rarefaction. The bigger the swing of the air particles the louder the sound, and the more rapid the swing of the particles the higher the sound. This theory was worked out in detail, with the result that the explanation of sound in terms of the movements of little particles was a complete success. But it was obvious that some new concept was required in order to explain light. Light is obviously not transmitted by the atmosphere.

If a vibrating electric bell be put in a glass jar and the jar exhausted of air, the sound of the bell becomes feebler and feebler until it becomes altogether inaudible. But we continue to *see* the bell vibrating as vigorously as ever. Further, light reaches us from the stars and we know that our atmosphere ceases to exist at a comparatively short distance above the surface of the earth. If light is due to motion in a medium, therefore, it must be a medium which extends as far as the farthest star.

An early theory, adopted by Newton, supposed that light was due to little corpuscles entering the eye after being shot out by the luminous body. In this way he explained the fact that light is propagated in straight lines. But he did not lay any great stress on this theory. He considered, also, the theory that light consists of waves in some subtle medium, or " ether," filling all space, although, if light is a wave motion, he thought it ought to bend round corners, as sound does. This difficulty could only be overcome by supposing that the light-waves are exceedingly minute. It could then be shown that the degree of bending should also be exceedingly small. The wave theory, in the hands of Huygens, showed itself a better instrument of research than the corpuscular theory, and its study was prosecuted with vigour.

The great problem presented by the wave theory of light was to determine the mechanical properties of the medium that conveys these waves. The fact that light is propagated with a definite velocity was established by the Danish astronomer, Römer, in 1676. He had observed that the satellites of Jupiter were sometimes irregular in their motions, and he had noticed that these irregularities depended on whether the earth was approaching Jupiter or receding from it. The brilliant idea occurred to him that, if light has a finite velocity of travel, it would take less time to meet the approaching earth than to overtake the receding earth. The velocity of light he deduced from his observations was astonishingly close to the value of 186,000 miles per second, which has since been determined by refined terrestrial experiments. The questions then arose : What are the properties of the medium that conveys light at this speed, and what is the nature of the waves ?

For some time the development of the theory of the ether was hindered by the assumption that light-waves, like sound-waves, are longitudinal—that is, consist in a to-and-fro motion in the direction of propagation. Certain experiments finally made it clear that this assumption cannot be correct, and that light-waves must be regarded as transverse—that is, as executed at right-angles to the direction of propagation, as occurs when a rope fixed at one end is shaken from the free end. When this fact was established the mathematicians were free to develop the theory of a medium that would support such vibrations. For years some of the best mathematicians in Europe devoted their attention to this problem. A great variety of ethers were worked out. They grew more and more complicated, and miracles of mathematical ingenuity were performed. But nobody succeeded in constructing a perfectly satisfactory ether. Nevertheless, the nineteenth century cherished an almost passionate belief in the existence of the ether. In spite of all failures, the idea that the propagation of light was susceptible of a purely mechanical explanation became an article of faith. Men like Lord Kelvin stated that the ether was the most real thing in our experience and its existence the most indubitable of truths. Yet it continued to elude satisfactory mathematical specification.

The death-blow to the mechanical ether was given by the publication of Maxwell's electromagnetic theory of light, although nobody—not even Maxwell himself—realised that fact at the time. Maxwell's theory was based on the ideas of Faraday, who was the first to regard the space surrounding an electrified body as a seat of electric force. The older theory regarded electricity, vaguely, as a " fluid " confined to the surface of electrified bodies. The attraction or repulsion between electrified bodies was explained as an " action at a distance " phenomenon. The force between electrified bodies was supposed to be exerted instantaneously across the space separating them. Faraday approached the whole subject from an entirely different point of view. He regarded the electric charges as setting up a state of strain in the space surrounding them, and he regarded the forces of attraction or repulsion as being due to this state of strain. Maxwell adopted this theory and developed it mathematically. As a result of this development, he was led to declare that electromagnetic forces are propagated through space with the speed of light. Further, his calculations showed that these forces must travel in the form of waves very analogous to light-waves. Maxwell did not hesitate to deduce that light-waves actually are electromagnetic waves, that light is an electromagnetic phenomenon. Thus was announced the greatest physical discovery of the nineteenth century.

Experimental confirmation of Maxwell's theory was not forthcoming for twenty years. It was not until 1886 that Hertz, by a wonderful series of experiments, obtained full confirmation of the Maxwellian theory. He designed an apparatus for producing an oscillating electric charge and found that he could produce electric sparks in a circuit at the other end of the room, although the two pieces of apparatus were not physically connected in any way. He also measured the velocity of propagation of these effects, and found that they passed over the intervening space with the speed of light. Further, he showed that they behaved like waves, strictly analogous to light-waves. He reflected them from the walls of his room and refracted them through a large prism of hard pitch. Further experiments by other investigators showed still more resemblances, and Maxwell's electromagnetic theory of light was definitely established. The practical application of this discovery resulted in wireless telegraphy and telephony.

But the immediate scientific interest of Maxwell's theory lay in the light it threw upon the problem of the ether. All etheric vibrations, it was now understood, obeyed Maxwell's equations. The problem, therefore, was to give the ether the mechanical properties that would be compatible with Maxwell's equations. Ethers of an altogether incredible complexity arose in obedience to this demand. They were so complex that it is doubtful, even supposing one of them to have been successful, whether it would have been accepted. It would so obviously have been much more a *tour de force* than a revelation of the workings of nature. But, as it happened, none of these ethers was successful. Scientific men began to realise that the explanation of all natural processes in mechanical terms was an impossible ideal. It became evident that henceforth certain concepts, other than mechanical concepts, would have to be ranked as fundamental for the science of physics. Electricity became a fundamental concept. No explanation of it in other terms seemed to be possible ; it had to be accepted as an ultimate fact of nature. Indeed, the inverse problem arose : Can mechanical processes be explained in terms of electricity ?

Although it became clear that a satisfactory description of the mechanism of the ether could not be given, the notion of an ether was not yet abandoned. The fact that light and electromagnetic processes in general are propagated through space with a finite velocity seemed to make the notion of a medium indispensable. And certain general questions could be asked about this medium, even although its constitution was unknown. The most important question was concerned with the relation between moving matter and the ether. Is the ether everywhere stationary, or does moving matter carry the ether along with it ? If the ether is everywhere stationary, then can the motion of the earth through it be detected ? A famous experiment, which has since been several times repeated, was undertaken by Michelson in 1881 to determine whether the earth moved through a stationary ether or whether it carried the ether in its neighbourhood along with it. The principle of the experiment is simple. Two equal arms are placed at right-angles and from the point of intersection a ray of light is passed along each arm and reflected back to the point of intersection. One arm points in the direction of the earth's motion in its orbit. The other arm is, of course, at right-angles to this direction. If the earth is travelling through the ether we should not expect the two rays of light to get back to the point of intersection at the same time. For if the earth and the ether are moving relatively to one another, the position would be analogous to that of two equally powerful swimmers, one of whom swims a certain distance up-stream and then down, while the other swims that same distance across stream and then back again. We know that, in this case, the second swimmer will make the faster time. Similarly, the light which travels along the arm at right-angles to the direction of the earth's motion through the ether should make the faster time. Nevertheless, the two rays of light arrived back at the point of intersection at the same moment. This experiment has been several times repeated. The apparatus has been turned at all angles, the experiment has been tried at various times of the year and at various heights above the earth's surface. Moreover, the apparatus is extremely sensitive, and can measure one-hundredth part of the effect to be expected if the ether is stationary. In every case the result is null.

Michelson concluded that the earth carries the ether in its neighbourhood along with it. But this conclusion entirely conflicts not only with other well-attested experiments, but also with certain astronomical observations of great weight and accuracy. In this dilemma it occurred to FitzGerald and also to Lorentz that the theory of a stationary ether could be preserved, in spite of Michelson's experiment, if we suppose that every body in its motion through the ether undergoes a certain contraction. If the arm of Michelson's apparatus which points in the direction of the earth's motion is contracted in a certain ratio, thus making the light-path shorter, the null result of Michelson's experiment can be explained. Numerous experiments were made to test this new idea, but no direct evidence for it was forthcoming. Lorentz showed, however, that the postulated contraction fitted in with the electromagnetic equations.

This was the state of affairs when Einstein published his *Restricted Principle of Relativity* in 1905. He there laid it down as a fundamental principle that the velocity of light, whether measured from a system in motion or a system at rest, has the same value. This is obviously a very extraordinary principle. We are required to believe that a ray of light overtakes a moving system (whether the system is moving towards or away from the light) at the same rate at which it overtakes a system at rest. How can this be possible ? We begin to see that the principle is not a mere contradiction in terms if we reflect that a velocity is the ratio of two measurements, a measurement of length and a measurement of time. It is evident that if measurements made from two systems in relative motion reach the same value for the velocity of light, then something must have happened to the measuring instruments. This is, in essence, what Einstein asserts. He says that length and time-lapse are relative conceptions—they vary with the state of motion of the observer. The distance between two events (say, two flashes of light) is not the same for observers who are moving relatively to one another. Nor is the time-lapse between these events the same for all observers. A man carries, as it were, his own particular space and time about with him. The behaviour of his instruments, his measuring rods and clocks, varies with his motion. From the point of view of a stationary observer the moving observer's measuring rod is contracted and his clock is going slow. We cannot speak of the " stationary " standard of measurement, however, and say that it should be preferred. For our use of the word " stationary " is quite arbitrary. There is no experiment whatever which will show an observer whether he is *absolutely* at rest. All systems in uniform relative motion are on exactly the same footing. What we have called the moving observer may quite well suppose himself to be at rest, and then the erstwhile stationary observer becomes the moving observer. And his measuring rod is contracted and his clock is going slow, judged from the point of view of the other observer. In fact, the same judgment is made about his measuring instruments that he makes about the other observer's measuring instruments.

Each observer, as we have said, carries his own space and time about with him. All observers who share the same motion make the same space and time measurements. Observers whose motions differ make different space and time measurements. But these variations in measurement are not, of course, arbitrary. They are connected together by the fact that all observers reach the same value for the velocity of light—namely, 186,000 miles per second. From this fact we can find the precise formula according to which space and time measurements vary with motion. It is hardly necessary to say that, by referring to an " observer," we do not imply that there is anything " subjective " or " psychological " about this theory of relativity. Instead of " observer " we could substitute the phrase " automatic measuring apparatus " without affecting the validity of any of our conclusions.

We have said that observers in different states of motion do not find the same values for the distance separating two events, or for the time-lapse separating two events. Now, all events exist both in time and in space. No event exists at no time at all, and no event exists nowhere. The complete description of an event involves both the specification of the place where it occurred and also the time when it occurred. Between any two events, therefore, there is a spatio-temporal relation—that is, a relation comprising so much of distance and so much of time. If the time-lapse between two events happens to be zero, the events are said to be simultaneous. If the distance is zero, then, of course, they occur at the same place. Since the time measurements as well as the space measurements of an observer vary with his motion, it follows that two events which are simultaneous for one observer need not be simultaneous for another observer. Simultaneity is a relative concept. This follows, of course, from the fact that time itself is a relative concept. Yet, although different observers estimate quite differently both the space and the time separating two events, there is, nevertheless, a certain relation between these events on which they would all be agreed. If any given observer takes his space and time measurements referring to any particular pair of events and combines these measurements in a certain way, he will get a certain result. If another observer combines *his* measurements for the same pair of events in the same way, he will get the same result. The manner in which the measurements have to be combined is very simple. The time measurement has to be subtracted from the space measurement—after suitable units of time and space have been chosen. But the precise technique of the process is of no present importance. The important fact is that there exists a relation between any pair of events which is the same for all observers. This relation, it is obvious, refers to something more fundamental than either space or time taken separately. It refers to something that does not vary with the motion of the observer. What is this something?

The correct interpretation of the fact that there is an invariant relation between any two events was given by Minkowski. He showed that this relation (which is called the *interval*) was, in its mathematical expression, analogous to the mathematical expression for a *distance*. He suggested, therefore, that the interval is a distance of some kind. But, if the interval is to be regarded as a distance, it must be regarded as a distance in a four-dimensional continuum. Minkowski did not hesitate to take this step. The actual universe in which events exist is, he asserted, a four-dimensional universe. Our minds split up this universe into three dimensions of space and one dimension of time. Different observers, as we have seen, split up the universe differently. They take different cross-sections, as it were, of the four-dimensional reality. Therefore, they have different space and time measurements. Only those quantities which refer directly to the four-dimensional reality itself are the same for all observers. Of such quantities the interval is one.

The fact that the interval could be regarded as a distance in a four-dimensional continuum immediately illuminated the whole theory of relativity. For it showed that the geometry that must be applied to the universe was not, as had always been supposed, Euclidean geometry. The reader is probably familiar with the fact that during the last hundred years a number of non-Euclidean geometries have been invented. For something like two thousand years it had been considered that the axioms on which Euclidean geometry are based are necessities of thought. It is now known that these axioms are, logically speaking, arbitrary. An entirely different set of axioms can be chosen and an entirely logical and self-consistent geometry be built up on them. All that is necessary is that the chosen axioms shall be consistent with one another. All geometries, Euclidean and non-Euclidean, are equally logical and self-consistent. There is no *a priori* reason for preferring any one of them to any other. It becomes a matter of experiment, therefore, to decide which of them can most conveniently be applied to the description of natural phenomena. The geometry we want is the geometry which will best describe the observed behaviour of our measuring appliances. Our measuring appliances may consist of rigid rods and mechanical clocks, or we may find it more convenient, in some cases, to use rays of light and vibrating atoms. The question is : What geometry best expresses their behaviour ?

We have said that Minkowski interpreted the *interval* as a distance in a four-dimensional continuum. Now Riemann, the great German geometer, had shown that the essential difference between all the different geometries, Euclidean and non-Euclidean, could be traced to the fact that each geometry gave a different mathematical formula for the distance between two points. The formula for the interval, if interpreted as a distance, made it clear that the geometry of the four-dimensional continuum was not Euclidean. Yet it was, in certain respects, very like Euclid's geometry, and for that reason was called " semi-Euclidean." But the differences are of great importance. It can be deduced, for instance, that in a continuum subject to this geometry there is a maximum velocity. In a Euclidean continuum, as we know, it is theoretically possible for an infinite velocity to exist. Whatever speed we suppose a particle to be travelling at, we can always imagine it travelling at a greater speed. But in a continuum governed by semi-Euclidean geometry this is not the case. An infinite velocity is not possible in such a continuum. The *ultimate* velocity is a certain finite velocity. It is, therefore, strongly confirmatory of Minkowski's conception that the velocity of light is found, in relativity theory, to play the part of an ultimate velocity. The velocity of a material body cannot, according to the theory of relativity, ever exceed the velocity of light. For it can be shown that the mass of a body increases with its velocity, and increases in such a way that at the velocity of light it becomes infinite. This increase in mass is not measurable except at speeds comparable with the speed of light. Some of the particles shot out by radium move at speeds sufficiently great to enable the increase of mass to be measured. At half the velocity of light the mass of an electron (or any other body) is increased by one-seventh. At nine-tenths the velocity of light the mass is nearly two and a half times greater, while at ninety-nine-hundredths of the velocity of light the mass has seven times its value at rest. At higher speeds the mass increases very rapidly until, as we have said, it becomes infinite at the velocity of light. This can only mean that the speed of light is a natural limit for moving matter. In a continuum governed by Minkowski's geometry it behaves, in fact, as if it were an infinite velocity.

There is another respect in which the velocity of light behaves as if it were infinite. We are accustomed to suppose that velocities can be added to one another according to the ordinary arithmetical law of addition. Thus, if a particle passed an observer with a speed three-quarters that of light, and another particle passes the observer in the opposite direction at the same speed, it would appear that the relative speed of the two particles must be one and a half times the velocity of light. Since all motion is relative, either of these particles can be considered as at rest, and then the other must be reckoned as moving half as fast again as light, thus violating the relativity principle that the velocity of light is an ultimate velocity. The fact is, however, that velocities do not combine according to the arithmetical law of addition. If a train passes an observer on the platform at sixty miles an hour and a man walks down the corridor with a velocity, relative to the train, of four miles per hour, his velocity, relative to the man on the platform, is not sixty-four miles per hour. It is less than this sum. The relativity formula for the addition of velocities shows that however many velocities relative to the same observer be added together their sum can never exceed the velocity of light. This strange result is again due to the curious geometry of the four-dimensional continuum. None of these results are perceptible, of course, except at speeds altogether outside our ordinary experience. Otherwise, we would not have had to wait so long for the theory of relativity.

Another very important result of relativity theory is the light it throws on the relation between matter and energy. There are, as is well known, various kinds of energy. Thus, there is the energy possessed by moving matter, as in the case of a rifle bullet, a stream, or a wind. There is energy of strain, as in a bended bow. There is heat energy, light energy, electrical energy. All these forms of energy are capable of doing work, and they can all be transformed into one another. Moreover, the transformation always takes place in a fixed proportion. The same amount of heat energy, for example, will always produce the same amount of energy of motion, or of electrical energy, or what not. Further, no energy is lost or created in the process of transformation. This fact is expressed by the principle of the Conservation of Energy. Energy is akin to matter in the fact that it cannot be either created or destroyed. But relativity theory has shown that the kinship is a much closer one than is expressed by saying that both matter and energy are conserved.

We have already said that a moving body has a greater mass than is possessed by the same body at rest. Now the moving body, in virtue of its motion, has acquired a certain amount of energy—kinetic energy, as it is called. According to Einstein this energy has mass. Indeed, the extra mass of the moving body is due to the mass of its kinetic energy. And what is true of kinetic energy is true of any other form of energy. All forms of energy have mass. Since mass is the cardinal property of matter, this fact suggests that energy and matter are convertible terms. We may regard the mass of a body at rest as the mass of the congealed energy, as it were, that constitutes the body. If matter could be changed into energy we should have incomparably the greatest source of energy possible. A thimbleful of mud, for example, if changed into energy, would be sufficient to drive a large ship across the Atlantic.

§ 7

A striking peculiarity of the Restricted Principle of Relativity, as we have described it, consists in the rôle played by geometry. Various phenomena, instead of being referred to special laws of nature, are shown to be consequences of the fact that the four-dimensional continuum is governed by a certain semi-Euclidean geometry. What, then, is the relation between geometry and laws of nature ? A simple illustration showing how this question might arise has been given by Poincaré. Let us consider the triangle formed by three stars. According to Euclid's geometry the three interior angles of this triangle should together equal two right-angles. Let us suppose that actual measurements of these angles show that they are not together equal to two right-angles. Should we conclude that Euclid's geometry is not the geometry of space ? Not necessarily. For in making these measurements we have assumed a law of nature—namely, that light is propagated in straight lines. It might be possible for us to account for our measurements by giving up this law while still retaining Euclid's geometry. This example is sufficient to show that what we call a law of nature may be at least partially dependent on the geometrical assumptions we begin with.[1]

The most celebrated of all scientific laws is Newton's law of gravitation. Newton imagined a force of attraction exerted between every particle of matter in the universe and every other particle, and he gave the law according to which this force varies with the masses and distances concerned. In particular, he gave an extremely satisfactory description of the motions of the planets by supposing the sun and the planets to be exerting this force of attraction on one another. It is interesting to see how far this conception of gravitation was necessitated by Newton's more fundamental assumptions. The only geometry known in Newton's time was Euclidean geometry, and Newton doubtless regarded Euclid's presuppositions as necessities of thought. When, therefore, Newton said that the natural motion of a body acted on by no forces is motion in a straight line, he was thinking of a Euclidean straight line. But the assumption that the unhampered motion of a body is motion in a Euclidean straight line makes the invention of a force of gravitation inevitable. The "natural" motion of a body, one would suppose, is the motion of a body which is not subject to impacts of any kind. But the planets are not subject to impacts. An earlier theory had supposed that angels carry the planets round the sun in just the way they are observed to go round. This may be called an " impact " theory. But Newton, needless to say, did not believe in any impact theory. Why, then, did not the planets travel in straight lines ? Newton concluded that there was a force pulling them out of the straight line path. He called this force " gravitation." It is to be observed that this force was invented purely because the planets did not behave as Newton thought unhampered bodies should behave—that is, they did not travel in Euclidean straight lines. Thus, we see that the force of gravitation was the inevitable outcome of Newton's assumption that the geometry of space must be Euclidean. If we do not make that assumption, can we get rid of the force of gravitation ? In other words, can we explain the observed motions of the planets as being their natural motions in a non-Euclidean space ?

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[1] For further discussion of this subject see the Article on *The Nature of Mathematics*, p. 188.

This was the problem that Einstein solved in his *Generalised Principle of Relativity*, published ten years after the *Restricted Principle*. The later theory may justly be regarded as a generalisation of the earlier theory, for while the earlier theory deals only with observers who are moving in straight lines with constant velocities, the later theory places no restrictions upon the motions of the observers. The aspect of the later theory that interests us here, however, is its attitude towards the whole problem of gravitation. Einstein showed that the force of gravitation is a superfluous concept, and that all the phenomena that had been accounted for by that force could be equally well explained in terms of a certain non-Euclidean geometry. In order to carry through this idea, Einstein had to adopt Minkowski's conception of a four-dimensional continuum. But he had to attribute to this continuum an altogether more complicated geometry than that proposed by Minkowski. We have already said that Minkowski's geometry is, in many respects, very like Euclid's. One very important point of resemblance consists in the fact that the natural motion of a body in a continuum governed by Minkowski's geometry is motion in a Euclidean straight line. Minkowski's geometry affords no assistance in the enterprise of abolishing the force of gravitation. Nevertheless, Minkowski's conception of the world as four-dimensional was an essential contribution to the general theory of relativity. If Einstein was to discover a geometry which would do the work of the force of gravitation, this geometry must be applied not to space only but to the four-dimensional space-time.

Einstein solved this problem. He showed that if the space-time continuum possesses certain metrical properties, then the motions of the planets are in the " straight lines," or geodesics, proper to this kind of continuum. In speaking of the motions of the planets we do not refer merely to their paths in space, their elliptical paths, but to their paths in the four-dimensional continuum, which are a kind of spirals. In the neighbourhood of a double star a planet's spatial path would not be an ellipse, and its four-dimensional path would not be a spiral. It would, however, describe the " straight line " appropriate to that part of the continuum. Thus, we see that the continuum must have different metrical characteristics in different parts of it, and that these differences are connected with the distribution of matter in the different regions. Thus, there is no one definite geometry that can be applied to the whole of space-time. The geometry required is a very general, flexible geometry, which admits of a considerable range of local variations. This general geometry, which Einstein has applied with such success, is called " Riemannian " geometry, from Riemann, who first discovered it.

The metrical properties, the geometry, of any portion of space-time, depend upon the distribution of matter in that region. A planet moves round the sun in an ellipse, not because there is a force of gravitation pulling at it, but because that is the natural motion of an unhampered body in the sort of space-time that exists in the neighbourhood of the sun. For the same reason a ray of light that passes near the sun describes a curved path. This fact, which was predicted by Einstein's theory, has been confirmed by measurements made by various eclipse expeditions. Stars near the sun (that is, in very much the same line of sight) cannot normally be seen, as their light is overpowered by the sun's light. But during a solar eclipse they become visible. If their light, in passing near the sun, is bent, it follows that the stars should appear displaced compared with the positions they occupy in the sky when the sun is not there. Einstein's theory enables the amount of the displacement to be calculated, and these calculations have been fully confirmed by observation. Time measurements, as well as space measurements, are influenced by the presence of the sun. A vibrating atom may be regarded as a natural clock, and it can be shown that atoms on the sun should vibrate more slowly than similar atoms on the earth. Thus, the light they emit, which depends on the rate of vibration, should be of longer wave-length than the light emitted by similar atoms on earth. This result has been confirmed by spectroscopic observation. A third result of the theory, which has also been confirmed by observation, deals with the motion of the planet Mercury. According to Newton's law of gravitation, an isolated planet should describe an ellipse round the sun. But no planet in the solar system describes a strict ellipse, since any planet's motion is influenced by the gravitational attraction of all the other planets. This influence is most apparent in the case of Mercury, for its orbit is the most markedly elliptical of any of the planetary orbits. When the calculations were made, however, it was found that there was a discrepancy between the theoretical result and the observed motion of Mercury. Many attempts were made to explain this discrepancy, but none of them was successful. Einstein's theory gives a complete explanation of the whole thing. These three observational results, together with the inner coherence and harmony of the theory, have caused it to be generally accepted. It may be taken as proved, therefore, that the universe exists in a four-dimensional continuum governed by Riemannian geometry.

Gravitation and all the laws of mechanics can be deduced from the fact that space-time is subject to Riemannian geometry. These laws are not special and isolated laws of nature. They are inevitable consequences of the geometrical peculiarities of space-time. Thus, the world has been immensely simplified. Instead of laboriously discovering one special law after another, we deduce them all from one set of premises. But the unification of nature is not yet complete. One great set of laws—namely, the electromagnetic laws which govern the propagation of radiant energy through empty space—have not yet been brought into the scheme. Also, relativity theory throws no light on the fact that matter is atomic in constitution, nor on any of the phenomena that are dealt with by the quantum theory. But certain steps towards a complete unification have been taken. Attempts have been made, for example, to bring electromagnetism into the geometrical scheme. The procedure, in each case, consists in inventing a geometry which, while allowing the laws of gravitation and mechanics to be deduced, shall also be sufficiently general to include the laws of electromagnetism. Electromagnetism, in fact, is to be made a necessary consequence of the geometrical peculiarities of the space-time continuum. It could be shown that the original Riemannian geometry used by

Einstein could not do this. All its geometrical peculiarities were exhausted, as it were, in accounting for gravitation and mechanics. A still more complicated geometry is necessary if electromagnetism is to be included.

One of the most interesting of these attempts is that of Eddington, and it is worth mentioning here because of the general nature of its conclusions. Eddington begins by attributing to the four-dimensional continuum almost the minimum amount of structure conceivable. Compared with the firm outlines of Euclidean geometry, the geometry assumed by Eddington is almost completely amorphous. Nevertheless, from this bare material, and making the minimum number of assumptions, he derives the laws of gravitation, mechanics and electromagnetism as being necessary consequences of this primitive structure. A piece of matter, on this theory, is a place where the continuum is curved in a certain way. It is not that the piece of matter produces the curvature; the curvature is the piece of matter. The " objective reality " is a continuum possessing certain kinds of curvature. As a result of the mind's selective action on this raw material the universe of physics, matter and its laws arise. Space and time are not fundamental on this theory. The "interval" with which Eddington starts is not, to begin with, a spatio-temporal relation. The mind splits up the interval into space and time components, but this is done in obedience to imperious psychological laws. The division into space and time is not imposed on us by nature; we impose it on nature. The whole universe of matter is, on this theory, a much more subjective affair than we had hitherto supposed. It arises as a result of the mind's selective action on certain raw material. A different mind from ours would fashion a different universe out of this same raw material. There are certain mathematical consequences of the existence of this raw material to which our mind pays no attention. Such consequences do not form features in the universe of our perception. Out of all the different aspects or combinations of the raw material the mind pays attention to some only.

What can we say about the nature of this raw material? Eddington maintains that, by the methods of science, we can learn nothing about the raw material except its structure. The primary elements of the raw material with which he starts are undefinable. He calls them " point-events," but all we know about a point-event is that four numbers are required to specify it. We can illustrate what this means by an analogy. To specify a house in New York, for instance, we require to know the number of the street and the number of the house in that street. To specify a musical note we require to know its pitch, its loudness and its *timbre*. Both pitch and loudness can be represented by numbers, and *timbre*, which is due to wave-shape, could conceivably be given numerical expression. If these particulars are given about a musical note they suffice to distinguish it from all other musical notes. Point-events, whatever they may be, require four particulars to distinguish them unambiguously, and each of these particulars can be represented by a number. That is all we require to know about point-events for the purposes of science. To use one of Eddington's illustrations, it is as if all we knew about the Big Four at Versailles was that they numbered four. Between pairs of point-events is a relation called the " interval," and this relation can be given mathematical expression. And from this the existence of matter and its laws can be deduced. Thus, the world of physical science is due merely to the *structure* of the four-dimensional continuum of point-events. Of the *nature* of the raw material science tells us nothing.

This attempt of Eddington's to geometrise the world has been mentioned chiefly because it affords a clear instance of his contention that science tells us nothing about the nature of reality, but only about its structure. This is a point of view which, as we shall see, is becoming very prominent in modern scientific speculation.

The fact that the four-dimensional continuum is governed by a non-Euclidean geometry raises the question as to whether space is finite. As long as space was supposed to be governed by Euclidean geometry such a question had no meaning. For to ask whether space was finite was equivalent to asking whether it had boundaries. Obviously, space cannot have boundaries, for what can we conceive to lie beyond the boundaries ? But it is possible for a non-Euclidean space to have no boundaries and yet to be finite. A simple example is provided by the surface of a sphere. Regarded as a two-dimensional object, the surface of a sphere is not Euclidean. On the surface of a sphere, for instance, the three interior angles of a triangle are not together equal to two right-angles. Creatures confined to the surface of a sphere and having no knowledge of a third dimension would develop a non-Euclidean geometry. And their space, which is the surface of the sphere, has no boundaries. These creatures could crawl for ever over the surface of their sphere in any direction without ever meeting any barrier to their further progress. They would come back to their starting points, but they would never reach a stop. Nevertheless, the total area of their space would be finite. Similar conclusions hold good when we come to consider a non-Euclidean three-dimensional space. It is possible for the total volume of such a space to be finite, although there are nowhere any barriers. It is, therefore, a perfectly sensible question to ask whether the space in which we live is finite but unbounded.

The notion that space is infinite has always been attended by certain difficulties. Consider, for instance, the distribution of the stars. Are we to suppose that the stars are scattered more or less uniformly throughout infinite space ? Or are we to suppose that they all exist within a limited volume of space, and that empty space spreads out to infinity in all directions about them ? Each of these alternatives has its own difficulties. If the stars are scattered uniformly throughout space, it can be shown that the night sky should be very much more luminous than it is. If the stars form an island in infinite space, then, under the influence of their mutual attractions, some of them should attain very great velocities. Such velocities have never been observed. Such difficulties are among the reasons that led Einstein to formulate the theory that the universe is finite but unbounded.

The theory that the universe is finite is now generally accepted, although there is some disagreement as to its form. But the theory which seems to be, on the whole, most probable assumes that time is curved as well as space. This universe has a tendency to expand. Particles initially close together tend to scatter. This is, to some extent, borne out observationally by the fact that the spiral nebulæ, which are considered to be

" island universes " quite outside our main galactic system, are most of them receding from us with considerable velocities. These velocities are deduced from spectroscopic observations. The light from the spiral nebulæ is displaced towards the red end of the spectrum, and measurements of the displacements enable us to calculate the velocities of recession. But this effect is complicated by the fact that the time dimension is curved. This will have the effect of slowing down all distant processes. The shifting of the light towards the red end of the spectrum may be partly due to the slowing down of time at such vast distances, for the atoms of the nebulæ, by vibrating more slowly, would send out a redder light than similar atoms on earth. At a certain distance, at what is called the " horizon," time would slow down completely and all natural processes would stop. This effect is illusory in the sense that if we transported ourselves and our instruments to the horizon we would find everything going on normally, and the horizon would now appear to be at the place we had left. This theory is due to the Dutch mathematician de Sitter. On Einstein's original form of the theory particles did not tend to scatter, and there was no slowing down of time. A form intermediate between these theories has been proposed, and the whole question is still in process of investigation. It appears, however, that the hypothesis of a finite, re-entrant space must be accepted. We may put it crudely by saying that space bends round on itself. This is not true, however, of time. There is no reason to suppose that time is " closed," and so there is no reason to believe in the nightmare of " eternal recurrence."

Time, in science, extends indefinitely into the past and indefinitely into the future. The scientific concept of time is as a bare succession. Future and past are distinguished merely by a difference of sign ; there is no essential difference between them. The equations which enable us to determine the future, as when we predict eclipses, can equally well be made to work backwards. It is doubtful whether this simple conception of time will always prove adequate for the purposes of science. It may be that something more akin to our intuition of a creative advance in nature will have to be adopted. However that may be, the present scientific conception of time regards the passage from the present to the future, or from the present to the past, as being no more than the passage to the right, or to the left, along a straight line. There is, nevertheless, one respect in which science recognises a difference between the future and the past when the material universe as a whole is considered. It can be definitely stated that the available energy of the universe is steadily becoming less.

We have already said that energy is conserved. The total amount of energy in the universe remains constant. In view of what we now know of the relation between matter and energy, this statement must be amended. We must now say that matter and energy, taken together, are conserved. This amendment does not affect the statement, however, that the available energy of the universe is steadily becoming less. Energy passes from higher to lower levels. Heat passes from a hot body to a colder one. This passage of energy can be used to do useful work. But no work can be obtained from a number of bodies at the same temperature. We may consider an isolated system, from which no energy is lost, and which is composed of bodies initially at different temperatures. In course of time all these bodies will reach the same temperature. They have not, as a whole, lost any energy, but their energy is now unavailable. In all energy transformations, whatever the kind of energy concerned may be, there is a loss of availability. The movement of the whole universe towards a uniform temperature is a process which, so far as we know, cannot be reversed. The general idea can be put rather differently if we say that the degree of organisation of the energy of the universe steadily grows less. In a swinging pendulum, for instance, the organised energy of motion is gradually transformed into a less organised form. The pendulum gradually comes to rest through the friction of its supports and through the resistance offered by the air. The energy of motion of the pendulum has been used up in increasing the chaotic motion of the air molecules and in heating the supports, that is, in increasing the chaotic molecular motions of the supports. The energy, in its organised state, has disappeared. The resulting disorganised energy, although quantitatively equal to the original energy, will never spontaneously assume the organised form. It has become less available. This change, from a more highly organised to a less highly organised form, is continually taking place in natural processes. And it appears that this process must inevitably go on until the disorganisation of the energy of the universe reaches a maximum. This final state, the end of the universe, must occur within a finite time.

If, using this same argument about the disorganisation of energy, we turn our attention to the past history of the universe, we see that the universe must have been more highly organised the farther back we go. This process, also, has its maximum. A finite time ago the universe must have been in a maximum state of organisation. This state could not have been evolved from any less organised state. It appears that the universe must have had a definite beginning in time. The accepted laws of physical science do not enable us to trace the universe through an indefinite past. Further, the chances against this highly organised state having come about at random can be shown to be practically infinite. The universe, as we know it, must have originated a finite time ago, and it could not have originated by chance. The origin of the universe, it would appear, is not a problem that can be brought within the scheme to which science confines itself. Whether this indicates that the universe had a transcendental origin, or whether it indicates that science, as a scheme, is not yet completely coherent, is at present a matter of opinion.

§ 8

The principle we have just described, the principle that the available energy of the universe grows steadily less, is known as the second law of thermodynamics. It is essentially a statistical law. It is one of those laws that do not deal with single elements, but with large assemblies of them. It is now realised that many of the older laws of physics are really only statistical laws and are derived from our experience of matter in bulk. When we come to study the actual elements of the physical world, such as protons and electrons, we find that the laws governing their individual behaviour are quite different from the laws governing their behaviour as assemblies. The most striking difference arises when we come to investigate the relation of cause and effect as applied to the elements of the physical world.

Physical science has long been supposed to present nature as a completely determined scheme. It has been a cardinal assumption of science that a given state of affairs determines uniquely the next state of affairs. If we are given all the relevant data about the present state of the solar system, for instance, we can predict any future state of the system. If we cannot do so it is merely because our observations are imperfect or that we do not know accurately the laws involved. In itself the system is completely determinate. In all the phenomena with which science was concerned this principle seemed to be verified. Predictions of eclipses, as everybody knows, come off. This principle was, by some people, generalised to include the phenomena of life and mind. Free-will was regarded as an illusion. Laplace boldly expressed the view implied in the beliefs of many scientific men when he stated that from the original distribution of the atoms in the primitive nebula a sufficiently great mathematical intelligence could predict the whole future history of the world.

The abandonment of this assumption is one of the most striking characteristics of the present scientific outlook. Strict determinism cannot be traced in the behaviour of the ultimate elements of the physical world. In these elements we include the " atoms of energy " or quanta, as well as electrons. The behaviour of a quantum of light as, for example, in which of two directions it will go, is found to be a matter of probabilities. In one experiment the quantum will choose one path. In a repetition of the experiment repeated under identical conditions it will choose the other path. If the experiment be repeated a great number of times, the percentage of the times the quantum chooses one path or the other can be reckoned up. It is then possible to enunciate a law specifying the probability that on any given occasion the quantum will take one path or the other. The same holds good of the motion of an electron. The chances that it will reach a position B from a position A can be given. But its future conduct is not uniquely determined by its present state. When a sufficiently large number of electrons are taken, as happens in any piece of matter with which science deals, their individual idiosyncrasies cancel out, as it were, and the resultant behaviour of the assemblage is determinate.

It might be thought that a closer observation of the electron would determine the conditions that cause it to jump one way rather than another. But an electron cannot be examined without interfering with it. An electron has a detectable existence only while it is interacting with the rest of the universe. An electron which is playing no part in the production of phenomena is in an unobservable state. But an electron cannot be detected (it could not, for instance, even be seen in an ideal microscope) without at least one quantum of energy being involved in the process. And this one quantum is sufficient to disturb the motion of the electron in an unpredictable way. Heisenberg's Principle of Indeterminacy states that an electron may have position or it may have velocity, but it cannot in any exact sense have both. The more exact the determination of the position of an electron the vaguer becomes its velocity, and the more exact the velocity the vaguer the position. How are we to interpret this principle ? Are we to say that it is merely an expression of the fact that our methods of measurement are defective—perhaps inherently defective—but that, nevertheless, an electron's behaviour is strictly determined ? Or are we to interpret the principle as an indication that the law of strict causality does not apply to the fundamental operations of nature ? At the present time scientific men are of two minds about this matter. Those who maintain that nature is finally undetermined ask what is the use of postulating a law of causation that can never be discovered ? If our measurements necessarily fail to reveal strict determinism, why assume that determinism nevertheless exists ? This question is very pertinent in view of the tendency of modern science to seek for no explanations except in terms of observable entities. By " observable " one must understand " detectable by physical processes." Newton, for example, explained the centrifugal force developed by a rotating body in terms of the body's relation to absolute space. According to Einstein, absolute space cannot be detected by any physical processes. He therefore regards it as an illegitimate entity in a scientific explanation. In Bohr's early theory of the atom we were asked to imagine electrons revolving round a central nucleus and occasionally executing jumps from one orbit to another. It was only while the electron was jumping that it interacted with the rest of the world. In the meantime, while it was steadily revolving in one orbit, it was immune from all detection. Bohr's picture of the atom therefore contained an unobservable element. Heisenberg replaced this scheme by one where none but observable factors was involved.

The banishment of determinism from the ultimate processes of nature is quite in keeping with this modern tendency. But is it possible to conceive of undetermined phenomena ? It would seem that the answer to this question depends on whether we think we have an intuition of free-will or not. If we can regard free-will as an unanalysable category of thought, then we may suppose something analogous to free-will to lie at the basis of material phenomena. Free-will and determinism then become theoretically two equally valid alternatives, and which one we adopt is to be decided purely by the evidence.

§ 9

We see that physical science has become a radically new thing since the days of Galileo. Science to begin with tried to account for phenomena in terms of notions made familiar to us by our ordinary experience, notions such as fluids, particles, pushing and pulling and so on. Up to a certain point this effort was successful. There are many phenomena which can still be accounted for in these terms, provided the analysis is not pushed beyond a certain limit. The first really big failure of this method of thought was the attempt to account for light as consisting in the vibrations of an elastic solid fitting all space. But although the elastic solid theory failed, the ideal of a mechanical explanation of light was not given up. The ether became more and more unlike anything in common experience, but the fundamental concepts used in constructing it were still mechanical. But the fact that no satisfactory mechanical ether could be designed led some to wonder whether the body of concepts that science had in stock, as it were, were really adequate. This moment was a turning-point in the history of science. Science no longer insisted that the description of the material universe *must* proceed in certain terms. Since then science has introduced a number of new concepts. But they have this in common with the old ones, that they are all capable of mathematical definition. Whatever words science may use for its concepts, light-quantum, distance, mass, four-dimensional continuum, electron, or whatever they may be, we find in each case that each of these words stands for a body of mathematical relations. Many of them differ from the old concepts in the fact that they are not picturable. But the " picturability " of the old concepts was really a quite irrelevant fact about them. The old terms, just as much as the new, stood for certain mathematical relations, and only so far as they did so were they of any importance to science. The fact that the Victorian " atom " conjured up the notion of a tiny grain of sand doubtless brought comfort to the mind, but it was only the mathematical specification of the atom that played any part in atomic theory. It is characteristic of the modern scientific man that he is sufficiently self-conscious to realise that he is *only* talking about certain mathematical relations when he talks about the entities out of which he intends to construct the universe. Provided that he has reason to suppose that his mathematical specification of an electron or what not is correct, he is not worried by the fact that the entity that fulfils that specification is not picturable.

This realisation of the nature of science makes it clear that the material universe is a much more subjective thing than Galileo, for instance, supposed. It is difficult now to make the hard-and-fast distinction between primary and secondary qualities that Galileo made. If our perception of the colour red is merely our interpretation of certain electromagnetic waves, our perception of a tennis-ball is, it appears on the wave theory of matter, merely our interpretation of waves that are still more mysterious. Or if we turn to relativity theory, we find that what we perceive as a tennis-ball is " really " a region of a four-dimensional continuum possessing a certain kind of curvature. Science does not tell us anything about the substance of the elements out of which we have built up the preceptual world. It tells us merely the mathematical specifications of those elements.[1]

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[1] The reader will find it profitable to read, in conjunction with this Article, the Articles on *The Nature of Mathematics* and *Astronomy*.

ASTRONOMY

By

R. A. SAMPSON

SYNOPSIS

Astronomy occupies at the present time a position of remarkable interest — Each of the physical sciences is now emerging into view of the others — What Astronomy has learnt illuminates physics and chemistry and in turn is illuminated by them — At the same time, in its own region, it has succeeded, far beyond what the most sanguine could have dreamed, in learning with certainty the nature, the position, the motions, even the constitution of the heavenly bodies — Our limit of knowledge, and even of ambition and ideas, a century ago, was the solar system ; this is now passed briefly by, as having little that is significant to tell — The stars are the real problem — We have successively found methods of reaching securely further and further out, and of determining the nature, the order and the structure of the stars — Not of individual stars alone, but their general history, grouping and genesis — Thence we are led on to wider theories of the universe as a whole — This Article attempts to convey a picture of this extraordinary field.

ASTRONOMY

THE GENERAL BEARING OF ASTRONOMY

The most evident contacts that Astronomy makes with other sciences are those with meteorology, with the geology that tells how the world came to be, and last, and above all, with physics. Though the subject matter of these sciences is at hand, while that of astronomy is remote and inaccessible, astronomy advanced towards certainty far in front of any of them. In spite of its remoteness, or rather because of that, it has progressed while they were stagnant, and has developed method after method, which have been handled by its students with the complete certainty of familiar tools. A glance at the reasons that carry so much certainty into such distant regions is far from fruitless. It is necessary, if one is to share the conviction, as well as the reserve, that astronomers attach to their own assertions.

The first reason is, that the material which the astronomer was obliged to contemplate itself defined and created science. Because the subjects of astronomy were remote and isolated, in the sense that those of meteorology were not, they became abstractions, with each element of the problem separate from every other, and at first sight independent of them. The needs of astronomy may be said to have created geometry. Mathematics has always been studied as an abstract science, but in its earlier days astronomy may claim to have given it direction, by putting to it a succession of problems just in advance of those it had already solved. Geometry sufficed for the need at first, especially the geometry of the circle and the sphere, which, naturally, were the first to be developed. Later it demanded, still as abstractions and for that reason a proper subject matter for mathematics, the geometry of more complex figures, with figures undergoing change, the effects of forces, and finally the generalities of Relativity. In all measures some error is involved, but a method of calculating the residue of truth that resides in the inevitable and conflicting errors that enfold it has been created, and this method, in a literal sense, transcends our own senses. And in the experimental region, and still because of its abstraction and isolation, it has furnished to physics, in the stars, a laboratory of experiments and demonstrations of circumstances that wholly outrun any provision it is possible to make otherwise, whether in space, time, mass or motion.

If we look at the picture from another angle, the gain is seen to be mutual. Astronomy may be said to have depended upon the advances of other sciences. It does so still. Any new method, such as an improvement in photography, or the development of the photo-electric cell, or radio, or the engineers' capacity to produce large work accurately, finds an application in astronomy. It is the same in theory. For the most part the astronomer has learnt to content himself with humble mathematics, because that part can be handled by people of no extraordinary capacity, whose main interests are not absorbed thereby. But each great advance, such as the development of a new method in mathematics, has carried astronomy forward to a new plane. The latest we have seen in our own day—the theory of Relativity, with its new formulation—almost an elimination—of gravitation. But as these methods grow more difficult, they become inevitably less fertile, because less easy to use.

Mathematics now, generally speaking, has outgrown its astronomical services, but its place has been fully taken by physics. Many, and ever more, developments of physical theory find their examples and illustrations in astronomy.

The characteristic of the subject matter of astronomy, in offering ready to hand the abstractions that mathematics and physics demand, is the essential reason for its rapid advance. The basis of its certainty, in dealing with matters so remote and measures so minute, is that its students have been compelled to go over the same ground again and again. There is only one solar system. The main facts about it, and even a correct geometrical description of it, have been known for about 2000 years. Some of the knowledge—that the Sun was the centre—was found and lost and found again. All other discoveries, even those that were impossible until the telescope was invented, were added as piecemeal extensions, confirming and making extraordinarily sure what was already known. Thus the successive revolutions of the satellite systems, the discovery of *Uranus*, of *Neptune*, and lastly of *Pluto*, the new planet, all bear that mark. They have extended ideas, but they have also fortified what was known, while correcting it and marking its limits. And, though high originality was required in the discovery, the past was so sure that, to the right minds, it suggested the future.

We may repeat the same theme without generalities, for the process of this sure and gradual extension of ideas is worth following. That the Sun was the centre of our local system was discovered by Greek science—Aristarchus (250 B.C.) taught it; but his ideas were still-born, because they came at a time when people were unable to appreciate their value. The system which was accepted right up to the late Renaissance was given by Ptolemy (A.D. 150). It made the Earth the centre; and though fundamentally misleading, in a sense it was correct, or nearly so, like a pair of gloves that only require turning inside out and will still fit, though on the other hands. When at length Copernicus introduced the modern system (1543), with a rotating Earth, revolving round the Sun, among the other planets, it was a revolution of ideas, but not of facts—the old facts were the same though arranged in a new order, and new facts fell into places already indicated for them. Astronomy however is now centred, not on the solar system, but on the stars. The Sun itself is a star—at first the statement was a guess, and it was looked at for at least three centuries before it gained much meaning. First of all, the scale of things which the fact involved had to be appreciated—the incredible distances between the bodies had to declare themselves by much collateral evidence, and finally the physical nature of the Sun had to be made out, and fitted in with the sequence defined by the other stars.

It is unnecessary to give other instances, for the whole of the following pages have been written from the point of view of gradual, inevitable growth. Astronomy is connected in common parlance with a set of startling discoveries. To the astronomer himself it appears much more a gradual unfolding. It will be appreciated that this attitude makes astronomers good and cautious judges of any new announcement.

THE SOLAR SYSTEM

When they are viewed directly, and as they presented themselves to the earliest observers, the Sun, Moon and planets show none of their true relationships. The Earth seems the most important body. The Moon appears as a body that may be compared with the Sun. The planets divide into two groups and have no likeness to the Earth. If we rearrange the same facts, but take the Sun as centre, the real system becomes evident. The Sun is indeed much the greatest body; it is a hundred times the diameter of the Earth, which means a million times its volume. It has 330,000 times its mass. Physically the Earth has no title to the chief place. The planets *Mercury*, *Venus*, the Earth, *Mars*, *Jupiter*, *Saturn* are spaced out, in their distances from the Sun, with a certain regularity which is emphasised by adding the ring of minor planets between *Mars* and *Jupiter*, and *Uranus* and *Neptune* beyond *Saturn*. They move round the Sun in the same direction, in nearly the same plane.[1] The system is evident, though no formula covers the succession of distances.

So far as we can examine them the planets present a wide range of surface conditions. This is to be expected, because their distances from the Sun would imply a great difference of temperature. If the Sun governs the temperature and there is no contribution of internal heat—a state of affairs that corresponds with conditions on the Earth—the mean temperatures would range from 200° C. on *Mercury* to —200° C. on *Neptune*. *Venus* would be about 70° C. and *Mars* —40° C. But such mean temperatures may allow a wide range, unless there is an atmosphere to trap incoming and outgoing heat. By inspection with the telescope, *Venus* appears cloudy, with little detail to fix on. *Jupiter* is certainly cloudy, though definite features, like what is called the " Great Red Spot," persist semi-permanently. It has a low mean density which suggests that the cloud layer may be deep. *Saturn* is much the same. Most of the others offer no definite information. *Mars* alone can be examined in some detail. It is small and its atmosphere is light. By putting together what different observers agree upon, it has been mapped pretty precisely, so that we can speak even of the changes that occur upon it. These changes follow its year. Round its poles, there are what seem to be ice caps, which increase and diminish. Concurrently, changes take place in its topographical features. What these are we can only guess. Large parts of it show an orange tinge, giving the planet its ruddy colour. One might suppose they are deserts. If we describe the rest as " vegetation " or " seas " we must do so with reserve, admitting considerable ignorance and keeping the temperature in mind. But in any case, this is far more than we know of the other planets. How difficult it is to learn, will be appreciated by saying that under the most favourable circumstances mapping *Mars* is like reading the inscription on a coin at a distance of several hundreds of yards.

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[1] The new planet *Pluto* cannot be included.

Three additions have been made to the major planets known from the beginning. *Uranus* was discovered by Herschel in 1781, because he saw it was not a mere point, like a star. *Neptune* was found by Adams and Leverrier independently, assigning its existence and place mathematically so as to explain why *Uranus* did not follow Newton's theory of gravitation. The planet was thereupon discovered within about a degree of the stated place, in 1846. Some fuller details of this are given in the next section as also of the latest addition to the solar system, the planet *Pluto*.

A word may be added about the Minor Planets. Of the thousand or more that are now known, most are an undistinguished horde whose orbits lie between those of *Mars* and *Jupiter*. But one stands out notably —*Eros*—because its mean distance from the Sun is actually less than that of *Mars*, while its least distance periodically brings it much closer. It is at these times our nearest neighbour. Thus its distance in 1901 was 30 million miles ; in 1931, 16.2 million only. Such occasions are far the most favourable that are offered for direct measurement of the scale of our system. The accepted distance of the Sun, 93 million miles, was so derived from the approach in 1901.

Coming to the satellites, except the Moon, no other was suspected until Galileo in 1610, a few days after he turned his telescope on the sky, detected, " with incredible jollity of mind," the four great satellites of *Jupiter*. He saw also later the ring of *Saturn*, but this was first recognised for what it was by Huygens in 1672. Huygens found too the greatest of *Saturn's* satellites. The ring itself is now known to be a host of small satellites, each moving according to an orbit of its own in *Saturn's* equatorial plane. J. D. Cassini added four more satellites to *Saturn*, W. Herschel two others, and two to *Uranus*. Two further satellites of *Uranus* were found by Lassell, who also discovered a satellite of *Neptune*. An eighth satellite of *Saturn* was found by G. P. Bond in 1848. Asaph Hall discovered two for *Mars* in 1877, the inner of which has the remarkable feature of revolving round the planet three times in the latter's day. More recent discoveries have not been wanting. Barnard added a fifth small inner satellite to *Jupiter* in 1892, Perrine two others outside the old system, Melotte an eighth and Nicholson (1914) a ninth, while W. H. Pickering added a ninth to the system of *Saturn*. While the earlier discoveries show on the whole a high degree of regularity in the systems, the outer members rather shake one's belief in its significance. The ninth satellite of *Saturn* goes backwards compared to the others. The eighth and ninth satellites of *Jupiter* do the same. The last two are also at enormous distances from the planet and subject to such enormous perturbations that no orbit fits them, and their places can only be computed step by step as needed.

The planets with their satellites, in their comparatively regular sequence, are not the sole constituents of the solar system. Much stranger members are the comets. We know them to be permanently attached to our system, because they share in the solar motion through space.

Several are detected every year, which usually make one revolution round the Sun and depart again to remote distances. The greatest recent comet of this kind was the " Daylight Comet " of 1910. A small proportion do not go far into space but return regularly, having apparently had their motion in approach to the Sun slowed down by a chance passage near one of the greater planets. Some eight or ten are thus definitely allotted as " captures " to *Jupiter*. The most famous of all the comets is Halley's, which recedes considerably beyond the orbit of *Neptune*, and revolves in a period of about seventy-five years, a period that varies according to chance encounters with the planets. Its return cannot be identified to a matter of five years without taking account of such perturbations. Yet they have been followed, with the help of Chinese and Japanese chronicles, back to 87 B.C. The most notable historical return is that figured in the Bayeux tapestry, contemporary with the Norman Conquest. The latest was in 1910, when the comet was a magnificent object for those favourably placed to observe it.

The nature of comets is imperfectly known. As they approach the Sun they are at first inconspicuous in appearance, presenting a hazy spot of light, so that Herschel first announced *Uranus* as the discovery of a comet. They grow in brightness and develop a bright condensation in the head and a tail, directed away from the Sun, sometimes of gorgeous proportions, and apparently consisting of matter ejected. One would suppose that a periodic comet of many returns would become exhausted in consequence, but Halley's comet hardly confirms this view. The tail is greatest after the passage past the Sun and diminishes as the comet recedes again. Not a few comets have been known to split into two, three or four parts, each following an orbit. The orbits of some comets are identical with orbits followed by certain swarms of meteorites, which we become aware of when the earth chances to encounter their stream and they show as " shooting stars " in our atmosphere. About a hundred known streams, with or without accompanying comets, have been identified. The mass of a comet is very small. When the comet is incandescent, the source of its light can be determined, and carbon monoxide and sodium have been detected besides reflection of sunlight. But these pieces of information are mere scraps—evidences of ignorance rather than of knowledge.

GRAVITATION

That the bodies of the solar system behave in a particular way, the greatest body dominating the motions of the rest, permits of a more comprehensive statement. Newton derived from this fact the law that matter attracts matter, particle by particle, with an intensity that diminishes as the distance increases, just as though a constant quantity had to be spread over an increasing surface. Though that discovery dates from two centuries ago, the theory is so well knit that it repays some detailed survey.

Most natural " laws " are accepted tentatively, until some better statement can be found. But the response to Newton's formula, wherever it was applied, seemed to be complete. The law was first indicated by the motion of the planets round the Sun, which might all, somewhat roughly, be treated as condensed points of matter, but Newton tried the wide assumption that the law was exactly true between all particles at all distances. Without pausing over the details, it may be said that this justified itself completely. It appeared for a long time that astronomy required and permitted no other formula. It seemed as if all the known phenomena—planetary perturbations, the intricate motions of the Moon, those of the other satellites, those of comets also, the movement of the Earth's polar axis, the determination of its figure and the variation of gravity upon it, the tides—gave no indication that there was anything to add to it. The labour of examination, throughout two hundred years, became greater and greater, but it was sustained by the confidence that nothing else was required.

Apparently the law extends also to the stars. In some cases, as for example when one star is known to move round another, an essential element in the verification may be wanting. And in the case of those groups of stars known as moving clusters, the distances may be so great that the operation of gravitation is insensible. Still no reason is found to call the law other than universal. Incidentally we may remark here on the illustration of the debt of general science to astronomy. The study of force, and the motion it produces, is more general than its astronomical applications. But except in the isolations of the heavenly bodies, examples could not have been furnished of verifiable motions in curves, and of the complicated rotation of a body about its own centre of gravity, whether free or under the action of forces. This is an earlier example, of which physics is now supplying many, of the necessity of astronomy to science in general.

The well-known example of the discovery of *Neptune* is an indication of the certainty of astronomical calculation. The planet *Uranus* did not conform to the orbit first assigned to it. A revision of the orbit failed in the same way. The departures were analysed independently by Adams and Leverrier as perturbations produced by an unknown planet and they succeeded in assigning a direction to this body, close to which *Neptune* was actually found. If the effect of the new body was included, the anomalies of *Uranus* were almost effaced.

But at the present day, we have had a still further example instilling confidence. The errors of *Uranus* were almost but not quite effaced. A certain systematic character in them convinced Percival Lowell, among others, that they denoted the action of a further unknown body, and by unsparing labour he assigned a place and magnitude to it. He felt so much confidence in his work that he provided after his death for the prolonged search that was necessary. A dozen years later (1930) a body was found agreeing quite strikingly with his forecast. He was wrong about its magnitude only, and that delayed success in the search.

This new " planet," *Pluto*, is in many respects unique. It is unquestionably a member of our system, circulating round the Sun. It is not a comet, for no comet is visible so far away. The older planets adhere pretty closely to a single plane of movement and to nearly circular orbits, with the exception of *Mercury*, which moves distinctly out of the common plane and in a very elliptical orbit. But *Pluto* shows more peculiarity in both respects. It would be easier to find its parallel among the minor planets or asteroids. Possibly it is only the first of a chapter of exceptions. There are some thirty million objects as bright as it is. Most of these are probably stars, but they have never been examined. There would be no reason for surprise in a new ring of asteroids beyond *Neptune*.

What is the nature of this tie that binds matter to matter ? Or again, what is matter, if we take this tie as defining it ? The only, and great, advance towards answering this question has been made in our own time, by Einstein. Needless to say it cannot be described rigorously while avoiding technicalities. The question is one of general physics, but again astronomy played an essential part in supplying a foothold for theory.

Einstein had developed an electrical theory which linked together space and time and made mass dependent upon the velocity with which it moved. It was frankly revolutionary, and though it fitted in with some indications from the difficult region of atomic theory, it might seem to have no bearing upon well-tried sciences like astronomy. But there was a known phenomenon which astronomers were unable to explain. When all the older forces and sources of disturbance were reckoned, the planet *Mercury* did not go as it might be expected to go. The point where it passed nearest to the Sun showed a minute shift, that nothing known would account for. Here Einstein entered, with the breadth and boldness that characterise all his work, and showed that the unexplained motion could be caused by the mass of *Mercury* varying with its velocity, just as that of an atom did. The revolution of ideas must be appreciated. A crevice had at last been found in Newton's law of gravitation. Mass, which was treated as a primary property of matter, now became a secondary one. Confirmation was given to the view that the primordial stuff of nature was not matter, but electricity.

The theory from which Einstein proceeded indicated that time and space meant different things to different observers. To any one observer they appear easy to distinguish from one another. But we are unable to carry over the identification from one observer to another ; there is no test by which we can try it. This is sometimes expressed by saying that we are quite unable to *prove* that any two events are simultaneous. Therefore if the phenomena are described over again in terms that do not assume time and space to be separate and real entities, with a meaning absolute and the same to all observers, nothing that is observable will be lost and some liberty of interpretation will be gained. Einstein accomplished this work of re-describing the phenomena, and it was a feat of genius. He included in the scheme the phenomena of gravitation. The result is his General Relativity.

So many things are taken for granted by all of us, which General Relativity dismisses as prejudice, that it is difficult to convey an idea of what remains. The amalgamation of space and time transforms all our conceptions, and leaves only a geometry of more than the three familiar dimensions. Gravitation even appears as a consequence of local twists in this geometry, the occasion or the cause of the twist being the presence of matter, or rather of energy, of which matter is one of the manifestations. Force is wiped out. What energy is remains unanswerable ; it is primal and there are no terms in which to explain it.

By this one piece of mathematics, all conceptions of time and space, supposed fixed, have been demolished and not replaced. The present writer may however record his conviction that, great as may be the extension of ideas and of power that Relativity has brought, until some way has been found to include electrical and magnetic phenomena in its scope, it remains essentially a geometrical *tour de force*, missing its veritable aim.[1]

THE SUN AMONG THE STARS

We are far from an end of what we have to learn from the solar system. The discovery of the planet *Pluto*, and, even nearer home, the unforeseen constitution and importance of the Earth's upper atmosphere as shown by meteorites, and by the transmission of radio-phenomena, prove the fact, if there were any doubt about it. Still, in an outline, which must indicate less the minute anatomy of the subject than its greater members, we must recognise that the stars, and not our nearest neighbours, claim attention. Our goal is to describe where the stars lie, what they are, and what systems they compose. But on many important points opinion is hardly settled. There are great technical difficulties. I shall attempt to indicate them in the course of these pages. The wonder is, that so much is sure. But not to exaggerate the authority of our statements, the best course will be to follow generally the historical development.

Describe the stars then, just as they appear upon the sky, first to the unaided eye, and finally to modern resources of registration. They are very evidently of different brightnesses, the so-called " magnitudes," and less evidently of different colours. Ptolemy, who worked with an arithmetic founded on the number six, as ours is founded on the number ten, divided those visible to his eye into six " magnitudes," each fainter than the last. This system is still kept, supplemented only to render it an exact tool. We fix a standard first-magnitude star. We define the advance of one magnitude as equivalent to a diminution of light 2.512 times. This is near the old estimate and implies that a star is scaled five magnitudes further down if its light is diminished 100 times. Hence twenty magnitudes meant a fall of intensity of light 100 million times. Such faint stars can be reached, but only with the most powerful telescopes and the longest photographic exposures. They are quite beyond the eye, even with every aid.

The brightest stars are few and well known. As we proceed down the magnitudes they become more and more numerous. Presently we have to be content with small sample areas, selected in all parts of the sky. Great care is necessary in choosing and counting these samples, and great care has been devoted to it. Finally, however we proceed, even counting must be given up. The numbers show no sign of stopping, but they outrun our resources of registration.

The counts and estimates may be put in a table as below, where the numbers given represent the stars that are met with if we go as far as the magnitude m (visual) given alongside.

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[1] The theory of Relativity is discussed in the Article on *The Physical Nature of the Universe*, p. 99.

NUMBER OF STARS BRIGHTER THAN VISUAL MAGNITUDE *m*

m	Number	*m*	Number
4.0	530	13.0	5,700,000
5.0	1,620	14.0	13,800,000
6.0	4,850	15.0	32,000,000
7.0	14,300	16.0	71,000,000
8.0	41,000	17.0	150,000,000
9.0	117,000	18.0	296,000,000
10.0	324,000	19.0	560,000,000
11.0	870,000	20.0	1,000,000,000
12.0	2,270,000		

In reading this table, it must be recalled that these are ordinary stars and do not represent the great clusters and groups which will be dealt with later and separately. If we make an attempt to arrive at a total, we must guess at the number that are beyond our counting. There is very little ground for saying they converge to a total at all. The rate of increase falls off a little, but this may be due, in whole or in part, to general absorption of light on its way to us. It seems as if we were safely within the mark in saying there are ten thousand million, or even a hundred thousand million stars separately registrable and on a par with our Sun. Perhaps no single fact in all our knowledge is more impressive.

Obviously the apparent brightness of a star will change with its distance. If we suppose the stars to differ in actual or intrinsic brightness according to any rule, but to preserve the same proportions at all distances, it appears that for each step of magnitude the number of stars would increase slightly less than fourfold. Looking at the numbers above, we see that the increases in number for one step in magnitude begin about threefold and fall gradually to less than two. The conclusion is that the distribution is thinner as it grows more remote. Apparently we belong to a very numerous cluster. Whether there exist other similar clusters outside our own is a question that will engage our attention later.

That there is a system of an extensive kind, of which apparently we are a member, is evident even to the eye. The "*Milky Way*" or *Galaxy* proves it. This broad band goes right round the sky, somewhat irregularly it is true; the Sun lies close to its central plane. Moreover it is evident on inspection that the apparent density of the stars increases progressively as the *Galaxy* is approached, quite apart from the great multitude of indistinguishably crowded stars that give it its name. The impression conveyed to the eye is confirmed when we arrange the full counts of stars according to distance from the galactic plane. We then find that there is an unquestionable progression. For stars of the fourth magnitude, there are about four times as many near the galactic plane as at its poles; for the twentieth magnitude, about forty times as many. We may conclude that the system we are describing is decidedly flattened, as Herschel concluded, something of the shape of an ordinary magnifying lens, the *Galaxy* lying around the rim and our Sun near the centre.

A less obvious method of investigation than mere enumeration, one of which the ancients knew nothing, and the value of which increases cumulatively as time passes, is the study of the motions of the stars among themselves. The " fixed " stars are far from fixed, putting aside those larger motions which are actually not a shift of the stars, but of the Earth, the pole and equator of which must be used as data for measurement. Out of a careful comparison of each catalogue of star-places with any earlier one, a number of " proper motions " is derived for the stars that figure in both catalogues. Until we know something about the distances, these are merely changes in the directions in which the stars must be looked for. Naturally they differ pretty widely in amount. A relatively large motion almost certainly indicates a relatively near star. The largest known motion is that of " *Barnard's Star*," which moves one degree, or the 360th part of the circle, in 360 years and turns out to be 400,000 times the Sun's distance away.

But let us rather speak of what emerges when we analyse the motions all together, and individual features are allowed to cancel one another out. In that case a certain definite residue remains, which we may attribute to the mass of the stars, or to the Sun or, more properly, we may take it as defining the Sun's motion relative to the mass of stars. It is directed to a point in the constellation *Hercules*.

If we take into account also the known distances of some of the stars and so convert their apparent change of bearing into linear motion along the celestial sphere, we can measure the solar motion as well as assign its direction, and it is about twelve miles a second. Though we assign this motion to the Sun and not to the mean of all the stars, it is merely a relative motion and there is nothing absolute about it. If we were able to compare the mean of our group of stars with the mean of another group, we should expect to find that they were also in relative motion with respect to one another, and we would be unable to give a meaning to anything absolute.

The solar motion is not the only systematic motion that emerges from an analysis of proper motions of the stars. If it is removed, the remaining motions are not random. There remain two preferred directions, which we know as " the two star streams." The points to which they are directed are opposite to one another, in the *Milky Way*, one in *Orion* and the other in *Scutum*. How many stars belong to these streams is not certain, but the number is very large. It may be the whole of the local cluster. Whether they are best described as two streams is not known, for there is an alternative way of putting the same fact. But the fact remains, whether we call it streaming, or preferential directions of spreading.

Less extensive systems have been detected, which are characterised by common motion. The first to be found was the *Taurus Cluster*. The clustering of stars in the *Hyades* is not illusory. They possess a common motion. More than that, a common motion links many unexpected but prominent members in other parts of the sky, such as five of the stars of the *Plough* with *Sirius* and a number of others.

All these apparently are threading their way through our system, and have been, for countless ages, without suffering any perturbation from other stars or even perturbing one another so as to converge—so feeble must be the gravitational influence of one star upon another.

Another point of view of stellar motions deserves mention. The first common effect to emerge is the motion of the Sun, as said above. If we regard it as a relative motion belonging to the stars, its amount, as a change of bearing, will be more or less according to the distance. But distance shows also in brightness, and though individually no connection may appear, if we take sufficient numbers a correlation will be shown between brightness, or " magnitude," and the solar motion, regarded as a change of bearings, and since we know what the solar motion amounts to this again may be interpreted as a determination of the actual average distances to be associated with a certain average magnitude. Such average distances prove to be quite reliable, and are an illustration of the collateral methods by which astronomers keep their scale in control.

All the foregoing conclusions suffer from the difficulty that the material becomes less and less palpable as the stars get more remote. Unless determinations of angular motion were cumulative and increased in precision with the lapse of time, they could hardly be used at all. Wonderful as it seems, there is another method, by which linear motions in miles per second can be found, and that irrespective of the distance of the star. This is due to the fact that light is transmitted in waves carried with a certain velocity, and a relative velocity of the source appears to the receiver as a change in the wave-length of the light. Such a change can be measured very accurately, so that motions of stars in the line of sight can be found, within less than one mile per second. Needless to say, a method such as this has many applications, some of which will be mentioned hereafter. In the present connection it will be seen how exactly it serves as a complement to the other method. All general conclusions that we derive from the one, such as the determination of the solar motion, can be derived otherwise by the other, in such a manner that the two methods check one another.

NATURE OF THE SUN

Leaving for the present the question of the distribution of the stars in space, we shall return to certain aspects of it after some discussion of their constitution.

We look to the constitution of the Sun, apart from any interest it may have in itself, as the best approach for understanding the nature of the stars. It is to be expected that we should learn a great deal more by critical examination of the phenomena of the Sun than by mere inspection, but it is surprising how great is the difference.

First regarding the Sun as our source of heat, the radiation received at the Earth may be estimated in different ways. It may be taken in the mass, receiving it in a carefully constructed absorber. After somewhat elaborate allowance for the part trapped in the atmosphere, we find that enough reaches each square centimetre of the outer atmosphere of the Earth to raise a gram of water 1.95° C. per minute. Calculating the temperature of a globe of the dimensions and distance of the Sun that would produce this, we find it a little below 6,000° absolute.

Or again, the heat received may be analysed, in respect to its intensity and according to its wave-length. It is then found that it agrees fairly well, though not perfectly, with the emission of an ideal radiator at a definite temperature—for which alone we can make a binding theory. The temperature of this radiator would be a little above 6,000°. No exact agreement can be found; the emissions are too strong at the red end and too weak at the violet. But the discrepancies are minor matters and leave us with a fairly well determined figure.

For information about the Sun, the spectrum is our chief document. If a small patch of sunlight is passed through a prism, it is spread out into a coloured band. The different colours designate different wavelengths or types, so that the band is in effect an analysis of the source of light, and may be used to compare the intensity of emission for all the various types. This is the way we compare the Sun with an ideal radiator at a definite temperature, for such a radiator emits the different types or colours, as blue, yellow or red, with intensities that are characteristic of its temperature. But we can do much more than estimate the balance of intensity for different colours. Sunlight reaches us deprived of some very significant elements. The spectrum, if produced by a narrow slit, is not continuous but is crossed by many thousands of dark lines, some exceedingly thin and faint, some broad and heavy, some sharp, some fuzzy, in apparently inextricable complexity. It constitutes the most precise as well as the most precious document in physics, and it has taken the better part of a century to unriddle it. It was found that these lines were characteristic of the chemical elements. The first thing learnt was the presence of sodium in the Sun, followed by the detection of about half the other elements, by recognition of the characteristic lines emitted by these elements. The lines are produced by a kind of contrast, when the element is present as a screen of lower temperature between us and the luminous disc. Hence we cannot prove the absence of an element from the fact that its lines do not appear, since it may be present low down within the luminous disc. The quality of the lines, their breadth, their intensity, has much to teach us of the state of the atoms that emit them, and therefore of the state of matters within the Sun itself, but this is best deferred until we can consider it in comparison with other stars.

Some features however we may deal with. If the element is in motion in the line of sight, the lines are displaced. For example, the Sun rotates, the east limb approaching and the west limb receding. We can measure the effect, and verify that the angular daily motion falls off from the Sun's equator up to 75° latitude, so that a complete rotation which takes place in 24.7 days at the equator, occupies as much as 33 or 34 days so far north or south as we can trace it.

But besides this constant effect, many local motions are shown, and some are exceedingly violent. The face of the Sun that we see is in furious turmoil, tempests raging to and fro with speeds like the volleys of an explosion. More systematically they show as whirling movements around the " Spots." These spots, not yet fully understood, are dark, or relatively dark, regions of lower temperature, that drift with the surface, and seldom endure more than a couple of months. A counter-clockwise tornado around a spot in the northern hemisphere is not infrequently associated with a clockwise system in the southern. They partake in the " periodicity " of the Sun, of which indeed they are the chief measurable indication.

This so-called periodicity of the Sun, though not prominent, is apparently deep seated, and can hardly be different in character from the much more pronounced recurring change that declares itself in many stars. Besides the spots, it is seen also in various other solar phenomena, in the "prominences," the type of the "Corona," and the magnetic effect of the Sun upon the Earth. It can be traced back almost as long as spots are observed. Perhaps because of the casual, unsystematic nature of the early records and the difficulty of tracing anything regular from the spots, the tale is far from smooth, but a chief period of 11⅛ years is clear, with a rapid rise from the least number present to the greatest, followed by a slower fall, broken half way by a pause. In this respect it resembles the characteristic type of change that is observed in much more pronounced degree in certain stars (p. 131).

The Sun presents to us strata as definite as, though different from, the gaseous, the liquid and rocky cloaks of the Earth with its unknown core. Starting from the interior, which only theory can penetrate and where circumstances must be very different from anything in our experience, we come to the opaque region known as the photosphere. It is from this that we receive radiation, for by some process the photosphere blankets the radiation from within. It is itself gaseous, but visibly also it is sharply bounded as, for example, is a cloud. Temperature and density fall, presumably, as we proceed outwards and only the lighter elements in the upper strata can announce their presence by spectral "lines" of absorption of hotter radiation from below. Some of the lines are of such a character that we can use them instrumentally so as actually to map the distribution of that species of atom in the Sun. Calcium, robbed of one electron, and normal hydrogen are thus continually charted. The calcium floats in bright patches or "flocculi" in the Sun's atmosphere, being specially dense over the spots. The chief character of the hydrogen distribution is found in immense trails of lower radiation. These are associated with "prominences," which are mainly jets of hydrogen—if anything going through its sequence so fast can be called a jet—into the relatively non-luminous upper strata. Relatively only, for there appears, when the disc is eclipsed, a streaked "corona," with no sharp boundary, and following in its changes the Sun's period of variation. In this corona the light gas helium was first discovered, and another which has been identified with oxygen in one of its "forbidden" states—forbidden, that is to say, or not occurring in our laboratories, where the atoms are still so close to one another that we can experiment upon them.

We think of the Sun's radiation as light, but as to how light travels our theories are only tentative. Certainly we must include, among what reaches us from the Sun, streams of electrified particles, which reach our upper atmosphere, being diverted towards the magnetic poles, to reveal themselves there in *Aurora Borealis* and disturbances of the earth's magnetism. The Sun itself is a magnetised body, with a general magnetic field, specially intense about the spots. Presumably this is no more than to say that the atoms that are found there are torn, temporarily, apart.

The mass of the Sun, which dominates the motions of the whole solar system and is felt beyond the orbit of *Neptune*, must be regarded as synonymous with a concentration of energy in a certain portion of space.

It is now held that as the Sun radiates energy—of which we receive a minute portion, a hundred millionth—its mass diminishes by four million tons a second.

The relations of mass with radiation are fundamental in the theory of Relativity. They were stated by Einstein before they were observed, in two other features. The gravitational field of the Sun disturbs the transmission of light. This was verified and measured by Greenwich observers in the eclipse of 1919. And the density of the Sun lowers the tone or, which is the same thing, makes redder the emission from all its atoms. It is difficult to detect this in the Sun, because the effect is small, and is over laid by other phenomena, but when we come to certain stars, the fact springs into cardinal importance.

THE SUN COMPARED WITH THE STARS

Having thus formed a descriptive idea of the Sun, we must next control or correct the presumption that it is a characteristic star. It may be said at once that the stars divide into two series or sequences—the so-called " Giants " and " Dwarfs." The Giant Stars will occupy us later. The Sun belongs to the other sequence, known as the Dwarfs—rather unfortunately, for a dwarf is an exceptional individual, and there is nothing exceptional in the Dwarf-series, nor are its members specially small. However, the term is established and we must use it, though we shall refer to it usually as the " Main Sequence."

The Sun's magnitude on the stellar scale, found by reducing its light suitably, is —26.7, understanding by a " magnitude " a step in intensity of brightness of more than 2½-fold, as explained above (p. 121). That of *Sirius* is —1.6, *Vega* 0.1, of *Altair* 0.9. It is so bright only because it is near. As we wish to compare the stars irrespective of their distances, we must introduce a conception which eliminates distance, by placing them all at a standard distance. The standard distance usually taken is about two million times the radius of the Earth's orbit—10 " parsecs " or thirty-three light-years, as they are called—taking a " light-year " as the distance which light would travel in one year, *i.e.* about six million million miles. The magnitude as viewed from this distance is known as the " luminosity " of the star, or sometimes as the " absolute magnitude." The luminosities of the stars named above are as follows : the Sun 4.9, *Sirius* 1.3, *Vega* 0.6, *Altair* 2.9 ; and this is fairly indicative of conclusions from fuller data—that the Sun is a normal star of rather low luminosity.

Before remarking upon these figures we consider other features. The light of a star can be analysed, in the same way as that of the Sun. Spectra can be obtained for the stars, just as for the Sun, though naturally with less detail. However, they make it very clear that a spectrum of the solar type is only a stage in a long series or sequence. They are divided into classes, to which names have been given—O, B, A, F, G, K, M, N, R. The classes merge into one another insensibly. The Sun belongs to class G. The classes may be distinguished approximately by colour, as blue (B), white (A), yellow (G), orange (K), red (M), deep red (N) or (R). More precisely they may be defined by the character of the spectral lines. From class O, bright lines are emitted. Class B form the helium stars, and show slight and faint absorption lines of any kind; in class A the hydrogen lines have developed to enormous strength, and metallic lines show their presence, especially the lines of " ionised," or electrified, calcium, called by their discoverer Frauenhofer (H) and (K). This (K) has nothing to do with the K-stars. In class F these are much developed and the hydrogen lines recede. Class G continues this process, and in particular the lines (H) and (K) are very heavy and broad. Class K shows even more absorption lines, the beginnings of general absorption and absorption in bands by certain compounds. Before this stage, chemical compounds, even the most refractory to heat, hardly declare themselves. In class M the general absorption increases, and in particular the spectrum is deeply gashed by a succession of bands that have been traced to the oxide of the metal titanium. The conclusion is inevitable that we are looking at a sequence, though whether it is a mass sequence—state depending upon size—or a time sequence in which each star passes through all the stages in succession, or whether there is some connection between the two ideas, must be left for further investigation.

Besides showing a progression in the development of the lines, the spectra show a variation of intensity in respect to the balance between the blue and the red ends. This feature, shown in a rough, but quite consistent way in the visual colour of a star, may be measured accurately by more refined apparatus. An ideal radiator would show a known and calculable balance of colours for each temperature, and we have seen that the Sun roughly approximates to an ideal radiator at a temperature of 6,000°. By assuming that the stars do the same, we can find their temperatures also, and those for each spectral class are now well established. A table is given below, with some further details (p. 133).

With regard to the masses of the stars, compared with that of the Sun, the evidence is sufficiently striking, though there is not very much of it. If collisions occurred between stars, mass could show in the effects, but as they do not, mass only shows in gravitation. No planets can be seen circling round the stars, and according to the current view, such a planetary system as surrounds our Sun exists only by the rarest accident. But a number of cases are known in which two *stars* circulate round one another, evidently by their mutual attraction. In fact such systems are of very frequent occurrence, and many more must exist than can be detected if we are to rely upon seeing the two components separated from one another, for it appears from theory that fission into two is a normal incident in the development of a star. If the motion of a double star has been followed over a sufficient portion of the relative orbit, and if in addition their distance from us has been ascertained, gravitational theory allows us to assign the sum of the masses of the pair. If, further, their motion can be followed separately by comparison with some independent standard, the masses can be separated from the sum. We conclude that a good many conditions must be satisfied before we obtain well determined masses, and it is not surprising that comparatively few are known with certainty. Few as they are, there is little doubt as to what they say. They show that not only is the Sun a representative star of its own spectral class, but that right through the main sequence, at any rate if we stop short of B stars, the masses exhibit a very small range. No star is known with a mass less than one sixth of the Sun, and this one is at the extreme red end of the sequence. At the other end, *Sirius* is about two and a half times the Sun's mass, and this is exceptionally big. If we arrange the masses according to the luminosity an even more striking result is apparent. But as this includes also the giant masses, as well as other outlying cases of high theoretical importance, detail with regard to it is deferred.

GIANT STARS

The increase in the masses of the stars as we pass upwards in temperature, from class A to class B, and beyond these to O, is very marked. Those at the top of class B are ten or twelve times as massive as the Sun. The highest known mass, by far, is of class O ; the star has two components, each probably 100 times as massive as the Sun. Concurrently the mutual orbits from which these masses are derived exhibit a progressive change. Those first found with the micrometer, the astronomer's instrument for measuring their visual separation, are of long period—very few being under a hundred years—and very elliptical. As we proceed to the other end of the sequence the period, and with it the distance of separation, diminishes and also the ellipticity of the orbit diminishes. The view is strongly suggested that we are viewing stages of a process of development, which begins with the " early " stars of high temperature and mass, and therefore of high luminosity, and continues down the main sequence, the mass gradually diminishing and the temperature falling, while the components of the " binary systems "—as we call a pair of stars circulating round one another—separate and circulate in more eccentric orbits.

The binary systems of *short* period are not revealed by the older methods of measuring separation and relative direction of two components with the micrometer. The two components are seldom distinguishable even as an elongation in the image. They are shown instead by periodic oscillations of the spectral lines about a mean place, defining a to-and-fro motion of the emitting body in the line of sight. Such systems, as has already been remarked, are very numerous. The method is another application of motion in the line of sight showing itself by a change of wave-length. Sometimes both spectra are visible and, not infrequently, are of different classes. What we can derive from such observations is restricted in the important respect that we cannot distinguish the inclination of the orbit, and the true dimensions are involved in this deficiency. On the other hand, we are given direct velocities without demanding a knowledge of distance.

It will appear below that these giant stars are, some of them, of enormous size. The star *Betelgeuse*, if placed where the Sun is, would extend to the orbit of *Mars*. This is exceptional, but it must be evident that two suns of this kind, revolving round one another in a few days, must frequently be in actual contact, or even intermingle their bodies, under which circumstances their differential gravitation, which is known as the tidal effect of one upon the other, would be of an order comparable with the main gravitational effect. This gives peculiar importance to another source of knowledge of certain systems, exceedingly precise and leading in certain cases to most valuable pieces of information not to be obtained otherwise. This is by the study of the light changes of pairs of stars that pass in front of one another and so eclipse one another.

Some, indeed many, of the stars vary in light. In some cases it is certainly due to an actual change in the star itself. In others it is equally certain that we happen to be in the plane of circulation of a close binary system and receive the light from the two discs, now separated and now hiding one another. Thus there will be two equal maxima of light, and two minima that will be unequal, if, as usually happens, the stars are unequal in size and brightness. The best known star of this type is the star *Algol*—*β Persei*—which in five hours loses two-thirds of its light, recovers it again in the same period, and remains at full brightness (with a slight secondary minimum that can only be detected by an instrument for measuring brightness) for 2¾ days, after which the same steps are repeated with perfect regularity. We are viewing an eclipse, and as the distance of *Algol* is known, by analysis of the phenomenon, we can tell the sizes of the discs of the two stars, as well as the masses. The important new fact that this approach gives us is the density, and this star turns out to be of low density—if not gaseous—about one-eighth that of the Sun, or one-sixth that of water. Other systems, also well observed, give much lower densities, some of them some hundreds of times less dense than air. Yet these huge spheres of gas, which are only distinguishable from a void by the greater void around them, emit light themselves and eclipse the light of each other.

Thus we must think of stars *preceding* the main sequence upon which the Sun is found as of greater mass, vastly greater luminosity and low density. But they do not progress continually to greater and greater effective temperatures. Theory would dictate that they reached a maximum of temperature after which they turned back, and this appears to be the case. Preceding the main sequence, where the order goes from B to M and the temperature falls in consequence, and uniting with it, say, at class B, we have a giant sequence of great stars of round about the same luminosity, which run through the whole series of spectral classes in the reverse order—that is to say from M to B, with rising temperature. A gap of at least twelve magnitudes separates the stars of class M, which are here at least true giants and true dwarfs. The M-giants are among the brightest, and the M-dwarfs among the faintest objects in the sky.

VARIABLE STARS

The eclipsing stars which vary in light, of which we have spoken above, owe their variation to the geometrical accident that we happen to lie in the plane in which they revolve round one another. But there is a true variation of light in a great many stars, in some cases regular and in some irregular in all degrees. Regular variation is illustrated by the star *δ Cephei*, whence we derive the name "the Cepheid type." The period of Cepheids ranges from about 100 days downwards to a few hours, and change in the period of a single star has hardly been established. The stars in question are among the greatest that we know. These very great ones are giants of class G, and of very low density. Those of earlier class are smaller and of shorter period. The luminosity may change from a barely sensible increase, up to more than double the minimum light emission. The change of brightness shows the feature of rapid rise to maximum and slow fall, punctuated by a hesitation. It will be recalled that the Sun's periodicity displays this also, though any attribution to a common cause is merely a speculation. By measuring the wave-lengths from known lines of the spectrum, we find that the radiant surface is approaching us and the temperature rising when the light is increasing, and receding with falling temperature when the light is diminishing, suggesting so strongly a pulsation within the body of the star that this is the generally accepted explanation.

The period of a Cepheid variable is intimately connected with its luminosity. This was first established by the discovery of a number of them in the smaller " cloud of Magellan," which is a remote group containing almost numberless nebulæ, clusters and systems, a veritable " island universe," where presumably any Cepheids that occur are at about the same distance from us so that their true luminosity follows their apparent magnitude. Though we have no explanation for it, this period-luminosity relation is so definite that it is used without question. And it has this important use—since it covers the periods of Cepheids in our own large cluster, which are remote stars certainly but not inaccessible by one means or another—we can translate the apparent magnitude of the others into absolute magnitude, and thus use in effect the immense distances of δ *Cephei* and *Polaris* and others which are not too remote as a new measuring rod for sounding the further depths of space. We shall have occasion to refer to this method again later.

Much less regular are the " long-period variables." The long periods are not very long, ranging from 250 to 1,000 days. Unlike that of the Cepheids, the variation is not so definite that it can be foretold with certainty, but when it comes it may amount to a change of many magnitudes. Thus the star called *Mira* (ο *Ceti*) frequently increases in brightness two-hundredfold or more, and this is not the greatest difference known. These stars, like the Cepheids, are great stars (though not so great) and of very low density. They are of low temperature and advanced spectral class, but they appear to be distinct from the Cepheids, and not to form a continuation of that sequence.

The Cepheids and also the long-period variables are often viewed as more or less regular pulsations in the body of the star. A third class of variation is more adequately regarded as an explosion. These are the Novæ. As a rule, though not always, such stars are known to break out only once. Some very faint star which has been, for all we know, steady and normal, increases its brightness perhaps a hundred-thousandfold in the course of two or three days and soon settles back, more slowly, into its old insignificance. Hence the disturbance, whatever its cause, must be called superficial. Meanwhile the spectrum shows, as might be expected, a tumultuous sequence of changes, but proving by the displacement in wave-length of the lines that can be recognised, that the luminous gases are rushing towards us as by an explosion. It is extremely improbable that it is anything else. It might conceivably be a collision, but all the stars are so small compared to their distances apart that a direct collision would occur practically never. Now the phenomenon of a Nova is not uncommon; a good many Novæ break out every year. Very few are remarked at the time, because great brightness is necessary at maximum in order to attract attention; the fact is established by examining stored photographic plates, covering the same region, where the steady brightness and sudden outbursts are found recorded.

The review in the last three sections of the nature of the stars will show that knowledge of the Sun is merely a key to the door, and though it is an indispensable and effective key we find, when we use it, that it opens to us a variety of unforeseen things.

NATURE OF THE STARS: OBSERVATIONAL

Following the idea expressed in the last paragraph, it might seem that the ground was insecure, when we came to describe the physical states of the stars which differ widely from the Sun or any matter we know upon the Earth. But astronomers hardly feel it so. Reference has been made more than once to the way in which one undemonstrative conclusion, perhaps little more than a surmise, serves to strengthen another of independent origin. Almost all the observations of the physical state of the stars are separately incomplete in this sense. But we piece the puzzle together and in the end get a picture which is not likely to want any large changes in order to put it right. This practice is well illustrated in what follows. We begin with stellar temperatures.

The temperature of the Sun may be derived from the whole heat received at the Earth, or from the same analysed according to its quality or wave-length, or again by consideration of the wave-length at which the intensity of emission is a maximum. All these depend upon well-established physical theory. They agree in indicating a temperature of about 6,000° absolute, which may be imagined as belonging to the opaque luminous disc at the base of the thinner solar atmosphere. It is undoubtedly gaseous there, but it is opaque; we get nothing from below it and can only penetrate it by theory.

Taking, now, what evidence we can about the stars, we may photograph their spectra and examine the variation of intensity as we proceed along it. Variation introduced by the method of reception may be allowed for, and the outcome is a curve of varying intensity that can be compared with that of the Sun, and assigns a temperature accordingly. Incidentally it confirms the supposition, suggested by observations of the Sun and also by theory, that the whole radiations of a star follow pretty closely those of the ideal radiator—the so-called "black body" of the physicist. The method permits of extension. Full spectra can be obtained only over restricted magnitudes, since the light must be spread out and therefore weakened, before a spectrum is recorded. But ultimately it is only the balance of intensity between the blue and the red that we require, in other words, the united effective balance of colour of the light considered as a whole. Accordingly a quantity called the "colour index" is studied, which may be found if we compare the magnitude of the star as photographed with that as seen, since the photographic plate is most sensitive to one colour and the eye to another. This can be pushed as far as where any stellar images will record themselves. It is found that " colour," as it would appear to the eye, or effective visual wave-length, can be assigned definitely. The method fits on to the other method and corroborates it. Further, it deals quite positively with the place where the main sequence of stars splits away from the giants, which occurs about class B. The temperature, in short, is found to follow closely the spectral class, the class of giants being somewhat cooler than the dwarfs of the same class.

Satisfactory as this method is, it is not the only approach to a solution. Actual quantity of radiant heat, spread out over a spectrum, has been measured. Naturally the observation is somewhat of a *tour de force*, and has only been effected with the greatest telescope there is, namely, the 100-inch telescope at Mount Wilson in California, and for a few of the brightest stars only. As far as extending knowledge goes, it affords another prop to what we have concluded otherwise. A definite prolongation of the series is given by a fourth method—the consideration of the appearance, preferably the maximum intensity, of chemical elements which have lost one or more electrons, as they may under sufficient agitation. If the sequence it gives is adjusted to known temperatures in the known region, it extends by a credible theory our knowledge into the unknown, just where the determination by colour or spectral balance becomes ineffective or fallacious. The following table shows approximately the results for the different spectral classes :

B	20,000°
A	12,600°
F	8,600°
G	6,200°
K	4,400°
M	3,500°

It will be remarked that there is nothing very extraordinary in these temperatures. The temperatures that must be assigned *within* the stars, ranging up to millions of degrees, are a very different matter and can be conceived only by theory. But the temperatures given in this list overlap at the lower end what can be dealt with on the Earth in the electric furnace and in explosions. We may regard them as immediately contiguous to ordinary experience. It is therefore doubly valuable that we can use them for another purpose, and incidentally confirm them. When the apparent size of a body is known and also its temperature, we can calculate the radiant emission we receive from it. For the stars, the last figures as magnitude and the first as apparent diameter, which is measured by the angle subtended. In other words, knowing the temperature and the apparent magnitude, we can calculate the apparent diameter. The following represents the results for a few of the brightest stars. For the case of these stars the distance is also known, so that we can find not only the apparent diameter, but the actual diameter. That of the Sun is taken as the unit.

Capella	12	*Vega*	2.4	*Companion to Sirius*	.034
Arcturus	30	*Sirius*	1.8		
Aldebaran	60	*Procyon*	1.9		
Betelgeuse	290	*α Centauri*	1.0		
Antares	480	*Barnard's star*	0.16		

These data, obtained first as above from theory, have been confirmed, and along with them the theory from which they spring, by a brilliant piece of direct measurement. It should be remarked that we can never see a true stellar disc, to measure it. It is overlaid by a much larger false disc produced by the scatter of light known as diffraction. Otherwise, though the quantities are small, some of them would have proved to be within reach. Obviously the biggest disc will be one that appears bright though of low temperature. This points directly to *Betelgeuse*, *Antares* and α *Herculis* as the most promising. But diffraction, which defeats us first by creating a false disc, has been made, by applying it otherwise, to yield up the secret. If the same source of light, proceeding through two apertures, is brought to a single spot, the united diffraction disc is found to be crossed by bright and dark bands, the separation of which depends upon the separation of the apertures. If two sources are presented at the same time, the bands can be made to disappear in the united diffraction discs, by separating the apertures suitably, so that bright of one compensates dark of the other. The two halves of a stellar disc may be regarded as the two sources, and thus the apparent diameter of the star can be measured in terms of the separation of the apertures that give an image free from bands. Though comparatively few stars can be treated in this way, and these with difficulty, it is enough, for it confirms that the diameters calculated from temperatures and magnitude are real ; if we want more than these direct measures can give, we can obtain them by the easier method.

There is a further confirmatory value in these numbers. Comparing the diameters derived with that of the Sun, it appears that over most of the main sequence, which is given in the middle column, the diameters do not range widely. They run down a little for the red dwarfs, and run up a little for high temperature stars. But for the giant red stars, to which the last entries of the first column belong, they are enormous. *Betelgeuse*, placed where the Sun is, would envelop the Earth and reach as far as *Mars*. Its volume would be about twenty-five million times that of the Sun. But so far no star has been found, and we do not expect any, with a mass greater than a very moderate multiple of the Sun's mass. Hence we have a confirmation of what we have already concluded from the showing of eclipsing stars, that these great stars must be regarded as composed of a gas as tenuous as would produce a pressure of about a thousandth of a millimetre of mercury. The standard pressure of the atmosphere is recorded in the barometer as the millimetres of mercury, so that the quantity is about a millionth of an atmosphere.

THE ATOM

It is almost impossible to give a lucid account of the stars without positing a knowledge of the structure of the atoms. The two are indeed very closely linked. Many of the details of the modern theory of the atom could not have been confirmed elsewhere than in the great laboratory of the sky. And our sole means of ascertaining the constitution of the stars and nebulæ, and much else about them, lies in splitting their light into spectra and then studying them by the help of a theory founded on terrestrial experiments.

The modern atom is a kind of solar system on a minute scale, too complicated for exact calculation, unfortunately, in any except the simplest cases presented. And here we may remark that though we are in the habit of speaking very definitely, as we do in describing the atoms, of " electrons " revolving round their nuclear " protons " in certain orbits, and so forth, this must be regarded merely as a manner of speech, designed to assist thinking and to point to the execution of certain calculations that work out. The less definiteness we give to our words, the less we are likely to be misled. It will be sufficient if we think of the electron as a particle, beyond conception small, and charged with an invariable quantity of negative electricity, while the proton is still smaller, nearly 2,000 times as massive, and charged with an equal quantity of positive electricity. One or more protons form a nucleus, and an equal number of electrons revolve around them with incredible speed; and each of the ninety-two chemical elements is characterised by an " atomic number," which is nothing but the number of electrons revolving round its nucleus in its un-electrified state. But there is much in the spatial specification that is obviously provisional, and which we should abolish without compunction if we could find an equally useful equivalent. Indeed it may be regarded as already abolished, and replaced by a " wave theory " which denies any permanent identity to the electron. But like the ray theory of light, which the undulatory theory supplanted, the current description as given above is too useful and too efficient to be discarded.

Any information we have of the constitution of the atoms is got from their spectra. The spectrum of the hydrogen atom is the simplest of all the spectra. It consists of a single series of lines in the visible region, proceeding from the visible red to the ultra-violet, at intervals diminishing in an obviously related manner, until finally the series converges upon a definite limit in the ultra-violet, beyond which the lines cease and a faint continuous band succeeds, extending until lost to view. Similar series of lines have been found in the infra-red and ultra-violet regions of the spectrum, into either of which regions the eye cannot penetrate.

It would take too many words to explain how this sequence, which anyone could recognise, baffled all theory, and finally forced upon us a revolution of ideas more drastic than that of Relativity. This is the " Quantum Theory." We now picture the hydrogen atom as consisting of a single electron, negatively charged, which revolves around a positive nucleus under mutual attraction, the whole being neutral electrically. Our older theories would have said that all orbits were possible for such a system, and the mere description of an orbit entailed emission of radiation. But we must conclude that that is not the case when we are dealing with an atom. Only those orbits are possible in which the so-called " action " steps up *by a certain definite amount, the Quantum*. This quantum is a fundamental unit in physics and, once known, can be detected over and over again as the true and only explanation of many facts otherwise unintelligible. The first orbit is the smallest orbit, of lowest action. As the action is increased by a step, the orbit grows larger by a step, until finally the electron has such a speed that it escapes from the pull of the nucleus altogether, and travels farther and farther away. The negatively charged electron and the positively charged proton have thereafter separate histories, and the system is said to be electrified or " ionised." The process by which quanta are conveyed to the atom, or from it, is radiation. When radiation strikes the revolving system, it can only be absorbed in definite quanta. When so absorbed, the electron is said to " jump " from one orbit to the next, and the fact is marked to our senses by the occurrence of one of the absorption lines of the spectrum. Such an absorption line, or emission line, therefore records the orbits between which the electron has " jumped."

This complicated and artificial description is forced upon us by the facts. It will be remarked how far it is from classical dynamics, which is a theory of the effect of forces in producing motion, and, like ordinary geometry, is founded upon axioms that are supposed to be metaphysically self-evident.

The hydrogen atom, and the nearly similar one of ionised helium, are the only systems simple enough to be calculated exactly. But, as was said above, the scheme extends itself to all the ninety-two elements; two electrons revolve around the nucleus of neutral helium, three round that of lithium, and so on. The orbits arrange themselves in a symmetrical but peculiar way, in a sequence of " shells," which contain when completed respectively 2, 8, 8, 18, 18, 36 electrons. All the chemical properties and the visual spectrum of each element depend upon the number of electrons in the outermost shell. If one is removed from an inner shell by any cause, radiation may be emitted, and the inner shell completed again by an electron " jumping " from an outer shell where the energy is higher. When the outermost shell is complete in its number of electrons, the element is practically without chemical properties, and we have the inert gases Helium, Neon, Argon, Krypton, Xenon, Radium. Helium is inert chemically and Hydrogen is active, because the two electrons of the former complete the first ring, while the single electron of the latter leaves it open. When an element is reduced by ionising it—that is by driving away one of the electrons of its outer shell—to a certain similarity of structure with the element next below it in the series, its spectrum becomes similar to the spectrum of that element, though the analogous features do not occur in the same part of the visible band. The word " similar " requires explanation. The spectra are too intricate for exact prediction, but they present recognisable features, sometimes very obvious visually, as pairs of lines, or lines in threes or more, the so-called " triplets," or " multiplets " of any complexity, and these are generally reproduced quite faithfully in the spectrum of the next higher element in the series when the latter is ionised.

Ionisation of an element, being the loss of an electron from its outermost shell, whereby it seems to acquire a positive electrical charge, is a very definite step, which takes place only under assignable circumstances. Hence when an ionised spectrum is recognised in a celestial body, it gives information of extreme precision as to the physical state in that body.

The atoms must be regarded as incredibly small and numerous and rapid in action. Unless search is made expressly, we apprehend nothing except the statistical results from the behaviour of great numbers, which may be quite different from the behaviour of any individual atom. Yet we know something about the behaviour of individual atoms; for example we know that they are not always the same; thus they interfere with one another. The spectral lines corresponding to the larger electron orbits are apt to be fuzzy, which means that they perturb one another and have not strictly the same period for revolving round the nucleus. They can be made sharp again by reducing the pressure, that is to say, by leaving more space to each atom.

As everybody knows, statistics mislead completely if applied to predict individual behaviour. " The unexpected always happens " because the expected, at best, is the average, and the happening is individual. A relevant example may be taken from the exchange of heat between bodies. A body, which is a perfect radiator and absorber, refuses to absorb or radiate indiscriminately, but preserves a balance between radiations of different types, which is related to its " temperature." This fact alone, well known and well established as it is, has been found impossible to explain without resort to a quantum theory, for which it becomes one of the fundamental proofs. Now temperature, viewed more closely, is a measure of the average relative agitation of the particles of the hot body. Hence we should expect, as in fact we find statistically, that a body can take up heat from one that has higher temperature, but parts with heat to one that has a lower one. But if we resolve the particles into chemical molecules and these into their atoms, exchange between two bodies becomes an average history of exchanges between the atoms. Thus if we calculate the temperature, say, of a particle of dust in space, exposed to the radiation of all the stars, it is found to conform to what we should expect in a relatively large body, and to be only a few degrees above absolute zero. But if we treat, not a particle of matter, but individual atoms, these can only absorb or emit radiation in a prescribed way, and if we calculate the temperature at which they are, it is found to be about 10,000°. Of course, though the temperature is high, the quantity of heat may be small.

In the same way we can generally only rob an atom of one of its electrons by somewhat violent means—high temperatures or heavy electric discharges through high vacua—but the isolated atoms that are found in space, and in the upper regions of our own and the Sun's atmosphere, appear to be mostly ionised. We infer that, having become ionised by some accident, the encounter with a neutralising electron is a circumstance too rare to be the rule. We shall see the bearing of these facts in the next section.

CONSTITUTION OF THE STARS IN THE LIGHT OF ATOMIC PHYSICS

The circumstances in the stars are evidently so different from any circumstances we can approach or handle here, that scruple is necessary in drawing any conclusions from them. We must build upon ultimate physical theory, or we shall certainly be led astray. That is the importance to us of atomic physics, which otherwise it would seem so paradoxical to introduce into astronomy. Our confidence in forecasts will be greatly strengthened by doing so. Accordingly we shall first point to many places, otherwise dark, which the conceptions of the last section of this Article illuminate. Such illumination is due, for, as already remarked, the current theory of the atom could hardly have been established without the evidence contributed by astronomy.

We turn first to the Sun, keeping an eye upon the application of terrestrial physics to its phenomena. We find that a great deal can be read about the occurrence of different elements at different heights in its " atmosphere " from a photograph of the spectrum of the narrow crescent which the Moon exposes just before a total eclipse. The crescent is so narrow a source of light, that in this case we do not need to make it narrower by interposing a " slit." For about a second the disc is shut off while the luminous atmosphere is visible, and as the Moon's disc is then slightly bigger than that of the Sun, it cuts across all the different levels of the solar atmosphere. An element which occurs high up records its presence by a longer line than one that is lower. The elements that are found to reach highest are the light elements hydrogen and helium, which we should expect, and ionised calcium, which might seem surprising, because there are many elements lighter than calcium. Extreme tenuity must be indicated. Even lower down, where neutral calcium also shows, far the greater proportion is ionised, and, for this to be the case, the general density must be low. Other circumstances confirm this conclusion. Since gravity on the Sun is twenty-eight times as great as on the Earth, under parallel circumstances we should have, not a tenuous, but a dense atmosphere. The balancing consideration that must be introduced to counteract a strong gravitational pull is the pressure of outgoing radiation. The mechanics of radiation enter very prominently in any theory of stellar states. Every dark line in the spectrum connotes radiant energy absorbed. A proportion of what is absorbed is re-emitted as radiation, but at a lower temperature, and moreover in all directions in place of directly outwards, so that a residue remains with the atom, counteracting the pull of gravitation. The importance of radiation pressure becomes still greater within the body of a star, and as will be pointed out below, may become the dominant factor, feeble though the force may be under terrestrial circumstances.

Returning to the lower levels of the atmosphere of the Sun, taken as a typical state, the features known as sun-spots, though embedded in the photosphere, exhibit unmistakably a lower temperature, namely about 4,000° in place of 6,000°. The evidence comes from various sources ; we have the general balance of emitted wave-length, the prominence of compounds like titanium oxide, cyanogen and hydroxyl, and the relative strengthening or weakening of certain spectral lines. The sun-spots themselves are certainly vortices, or whirling storms which may be the ends of long, whirling filaments, sometimes just breaking out to the surface, and there spreading outwards laterally and lowering their temperature by this expansion. The whirl can be seen in suitable photographs, and the whirling " ions," that is to say, broken atoms, generate a strong magnetic field, which can also be detected by suitable apparatus. The sun-spots recur with a period of about eleven years, but alternate sun-spot periods reverse their magnetic field, so that a full period must be thought of, not as eleven years, but twenty-two. In less degree a magnetic field has been traced over the whole of the Sun, just as we have a magnetic field over the whole of the Earth, the poles approximating with the poles of rotation, as they do on the Earth.

We have thus good grounds, in confirming what we know, and illuminating its meaning, for pushing further the application of atomic physics, in order to assist our comprehension of the state of affairs within the Sun, and therefore within the other stars. The first problem that meets us is the opacity of the disc. Why can we not see right into the Sun ? It is not due to sudden change of density—there is none. The answer is that it is due to ionisation. An ionised gas will trap radiation, as has been verified by terrestrial experiments, and therefore prevent us from receiving the radiations from within, by which alone it would be possible to see the interior. Hence, enormous, by our standards, though the energy emitted by a star may be, it is merely a leak. The main part of radiant energy and of the irregular motion that we know as heat, is semi-permanently trapped within. Now violent motions at close quarters mean electrons frequently displaced, so that we must think of the characteristic atoms as stripped of part or all of their outer shells of electrons. So far as we know they do not lose their identity and, if placed again under suitable circumstances, would speedily assemble the normal shells about their nuclei. But there is a consequence of the first importance. The nucleus is very small as well as very massive. If stripped of its shields, it may and does present densities exceeding thousands of times anything known in circumstances we call normal, though at the same time it has the free mobility of a gas. The density of the Sun exceeds that of water by forty per cent. And it used to be a problem whether its interior was gaseous or liquid. But the density of the faint and tiny F-star that accompanies *Sirius* exceeds that of the Sun 36,000-fold. But since this arises from stripping the outer shells of the atoms, there is no reason to treat either body as other than a perfect gas.

The best theory shows that the temperature must rise within the body of a star to millions of degrees, and as the temperature rises, the pressure of radiation rises enormously too. It rises at a greater rate than gravitation, which it opposes, and accounts for the fact that the stars are not greatly more compressed than we find them and than we should expect them to be from their great masses. At a certain point indeed radiation-pressure would become greater than gravitation, but if that were reached, expansion would reduce it again, and we should have a pulsating body. This may be what we witness in the Cepheid variables. If the circumstances were such as to make radiation-pressure greater still, the star would fling itself apart, so that there is an assigned limit to the size of the collections of matter we know by the name of " star." Or again, we may have a border-line case such as a Nova seems to illustrate.

The luminosity, or shining, of a star is, as has been said above, a mere leak. It may however be calculated from physical theory when the other circumstances are known, and though the calculation is difficult, it verifies itself over so wide a range that there can be little doubt that it is reliable. It turns out that the luminosity may be assigned when the mass and surface temperature alone are known. The other factors, the size, the density—its distribution and its average—simply do not matter. This covers stars in such diverse states as the *Companion to Sirius* on the one hand, where the density is 30,000 times and the radius one-thirtieth of that of the Sun, and, on the other, *Betelgeuse*, where the density compared to the Sun is one-millionth only and the radius 300.

The low densities which are found at a small distance from an immense mass like the Sun must be still more pronounced in the loose bodies known as the gaseous nebulæ. Some of them, stretching over a large part of the sky, are wholly dark. The " rifts " that are seen in the continuity of the *Milky Way* are of this character. Possibly all are dark ; at any rate we know that some at least owe their luminosity to stars embedded in them, which light them up like an incandescent lamp within a globe. But unlike such globes they show spectra of characteristic bright lines. In default of knowledge the element producing this spectrum was called " nebulium," until it became clear that there was no room for any element of that kind. At the date of writing, only two elements are undiscovered, but their properties can be predicted, and, among other things, they are heavy, whereas the matter in the nebulæ must certainly be light. Hence we have gradually become pretty sure that " nebulium " was merely a familiar element in an unfamiliar state ; but only recently has its secret been disclosed. Among the great variety of changes between two orbits which are theoretically open to the electrons of most elements, are certain modes that are " forbidden," in the sense that the lines corresponding to them are not met with. The reason is that an electron, jumping to one of these orbits, remains in it perhaps a thousand times as long —so long, say, as a thousandth of a second—as it would in other orbits. Hence the absorption or emission that is related to it does not occur often enough to be seen. There are such lines possible in singly ionised nitrogen, and in singly and doubly ionised oxygen, and they have been shown to account for the mysterious " nebulium." Such a proof is not a conjecture. It follows the severest test of numerical agreement to five or six figures. One may ask why these " forbidden " states occur in the sky. The answer is that the matter in question is already ionised, and is so tenuous in density that the encounter of an " ion," that is a broken atom, with an electron or another ion, is in any case so rare that the " forbidden " states lose their peculiarity.

The " empty " space of the sky is nearly, but not quite, void of matter. Almost no general absorption takes place, which would be our ordinary test for the presence of matter there, even from remote stars, but these expanses have been found to contain enough atoms of ionised calcium and also of normal sodium to produce the characteristic absorption lines of such elements. At first these lines were attributed to the star by whose light they were seen, but whereas the other lines of the star showed the displacement of wave-length that is interpreted as motion, the calcium lines were steady. Their true origin as due to diffuse inter-stellar matter has been confirmed by measuring their intensity, which increases for remoter and remoter stars.

The presence of matter of such specific kinds in the depths of space presents the intriguing questions of how it got there, and whether there is anything else. As to the latter point, there is certainly something else and something different from any matter or radiation that we encounter otherwise. There are the " cosmic rays," recently discovered and the nature of which is still mysterious. They come from the depths of space and are not related to the position of any of the most probable sources—the Sun, or the *Milky Way*, or the nearest great nebula in *Andromeda*. The Earth is bombarded by them wherever it goes. They have a penetrating power that much exceeds any other that we know, and would pierce some twelve feet of lead. Whether they consist of particles or ether waves has not yet been determined ; nor what they mean, though so much energy can hardly result except from the merging of simple atoms into more complicated ones, or even the destruction of an atom altogether by the union of an electron and a proton, which seems to be theoretically possible.

That matter is destroyed in some such way, in the processes we witness in the sky, and energy given forth as radiation, can hardly now be considered a question of debate. Any other imagined method for maintaining the radiation of the Sun, for example, of whose duration in its present form we have some idea from geology, proves on examination to be hopelessly inadequate. Thus if we consider gravitational contraction, this would supply energy to correspond with current needs, but it would postulate a quite different Sun twenty million years ago ; and other supplies are still feebler. The interior of a star, as we have described it a little way back, seems exactly the place where head-on encounters of electrons and protons may be met with, and we conceive that the result of such an encounter would be the disappearance of " matter " and the generation of a relatively enormous quantity of radiant energy. The Sun's radiation, though only a leak, is very great ; in order to balance it, the Sun must lose matter at the rate of four million tons a second. But there seems no reason to call this quantity improbable. Even at this rate, its mass is so great that the supply would last twenty million million years.

GLOBULAR CLUSTERS

Leaving for the moment these matters which lie on the border-line between experience and speculation, let us proceed with the description of what is found in the skies. Next beyond individual stars come clusters of stars, and of these the most easy to characterise are the globular clusters.

The globular cluster in *Hercules* is the one best placed for northern observers, but if we describe one, apparently we describe all, for they are extraordinarily alike. Seen by the eye as a single star, the cluster in *Hercules* is resolved by the telescope into a multitude of very faint stars, scattered with a regularity, which is presumably merely an average from a large number of irregularities, over the whole field, and concentrating more and more densely to the centre. A good photograph shows much more. There are at least 50,000 stars in this cluster, and they concentrate so closely on the centre that they run over one another and become indistinguishable. About ninety of these clusters are known ; they appear to be centred about a point in *Sagittarius*, in the *Milky Way*, and the Sun shows no sign of relation to their distribution.

This might have been all we know about them, if Cepheid variables (p. 130) had not been found in them. The Cepheid variables in these clusters are of extraordinarily short period—half a day or thereabouts. Now from the period of a Cepheid variable we can infer its real brightness, and if this is done, these apparently very faint stars turn out to be intrinsically highly luminous, so that their apparent faintness is no more than an effect of great distance. Comparing the apparent magnitudes with what we can infer of their real brightness, we can tell the distance that they are at. From such a calculation it appears that the cluster in *Hercules* is distant from us some 35,000 light-years. The nearest of the globular clusters, that in *Centaurus*, is 21,000 light-years. Most of them are much more remote.

In fact we require some more powerful method even than that of detecting variables, in order to get their scale of distance. Such methods have been found, depending on the great similarity between different clusters. The simplest is nothing but a comparison of the apparent diameters. Another depends upon the brightest stars in the cluster. Trusting to these, one cluster has been found to lie ten times as far away as the cluster in *Centaurus*.

It is unnecessary to spend words in attempting to make these figures more impressive. They are measures, not vague surmises. They may be disturbed in detail, perhaps, but not in scale. They extend our knowledge in a way that prepares for further extensions. They represent something, obviously systematic and utterly beyond what we could measure, or could hope to measure, using as scale the ordinary " astronomical unit," or distance from the Earth to the Sun—ninety-three million miles. They ignore the Sun in their arrangement, and point to another centre.

We may record a few further details. Their motions are large, both relative to one another and relative to the Sun. Each cluster separately may extend to a diameter of about 100 light-years. The star density at the centre is about 1,000 times as great as it is near to us. In spite of this, the stars that compose them are presumably at great distances from one another. It must be remembered that even if our neighbours were tenfold nearer, which would increase the density a thousandfold, they would still be very remote. The greatest stars within the clusters are red supergiants with diameters two or three hundred times that of the Sun, like *Antares* and *Betelgeuse*.

THE SPIRAL NEBULÆ

Next in order of hierarchy beyond the system of globular clusters are the nebulæ. There are nebulæ which seem to belong to the *Galaxy*, and others styled extra-galactic nebulæ. We shall treat the former very briefly. Although few in number, they are remarkable, most because they are gaseous. What their spectra show has already been dealt with (p. 140). They are apparently envelopes, consisting of light atoms, ionised and in a state of great tenuity, surrounding some star from which they receive radiation, to emit it again with a stamp of their own. They are of great dimensions, probably exceeding many times the whole solar system. So far they have not been connected rationally with any other formation.

Quite other are the extra-galactic, or spiral, nebulæ. For one thing, the spirals are both enormously greater and enormously more numerous, so that it is a moot question whether they are not the generating points from which the whole celestial panorama unfolds. They are also, as will appear, enormously more remote. Without being moulded exactly upon one pattern, they present unmistakable signs of a common chain of development and vary from one another by their stage of advancement, and by circumstances one calls accidental.

The name " spiral " is derived from the form assumed. If we imagine a tracing point to go round and round the origin from which it started, but to get continually further away, it will trace out what geometers call a spiral. Such forms are shown with the utmost clearness in some of the spiral nebulæ, only in place of one spiral we have two, starting from the same origin, interlocked and just opposite to each other.

The most prominent, and presumably the nearest of the spirals is the great nebula in *Andromeda*. On a photograph, a record can be obtained, stretching across fully a degree of the sky, that is, twice the diameter of the Moon, though the eye sees only the condensed centre as a hazy star. It appears as oval in form, with fissures that might mark a succession of rings, but if we take the other spirals to interpret it, we see that we are viewing in perspective a flattish object, lying near to one plane, with a central nucleus from which two long arms extend round and round it in what are spirals pretty close to the type called " equiangular."

Learning from other spirals, we see that the nucleus lies equally above and below a certain plane of symmetry ; it may be round or oval shaped or flattened ; in the last case it is frequently, and apparently characteristically, obscured along its central plane of symmetry by a dark band, which has been interpreted as an escape of matter from it, cooled by the escape. The arms, or spiral prolongations, from the nucleus lie also in this plane of symmetry ; they may be more or less extended and regular, or not at all. They are punctuated throughout their length by condensations, which are stars.

The nucleus is much brighter than the arms. In the *Andromeda* nebula it is impossible to secure a photograph of the extensions without greatly over-exposing the central part. And in most of the photographs the image has a " woolly " look that strongly suggests an incandescent gas, with a soft boundary. Yet it is uncertain whether the spirals are truly gaseous at all. Their spectra are continuous, generally of the solar type. And high telescopic power separates at any rate some parts of them into distinct stars which run into one, as the *Milky Way* does, under a lower power. These may be plunged in nebulous matter, which they illuminate. The spirals range downwards in apparent size, from the *Andromeda* nebula, which is the greatest, because, as one supposes, it is the nearest, through a number of other striking examples, until we come to a host of small patches of light that it is just possible to recognise as belonging to the family. Their number is enormous. Probably the telescopes at present in use could record half a million. And each of them that we can examine in detail envelops a countless host of separate stars.

There seems no room for systems on this scale, within any other system than their own. And indeed they hardly seem to belong either to us or to one another. An estimate has been formed of the distance of the nearest—that in *Andromeda*—following the method that proved so reliable for the globular clusters. Some minute stars, of the eighteenth magnitude, which means an exceedingly faint star, were recognised as Cepheid variables. Their period gave their actual brightness, namely 5,000 to 10,000 times brighter than the Sun, from which a calculation shows that this nearest of the spirals is nearly a million light-years away. Indeed there is some reason for saying that the spirals are on the confines of space, if we are to suppose that space has any limits. For their velocity towards or away from us can be determined in a number of cases, and after removing an enormous motion relative to the Sun, with one accord they show a still greater velocity of recession, or departure, from one another. No one has suggested a reason why they should spread out in this way, so that one is disposed to accept the interpretation which General Relativity would put upon it—namely that it is not an actual recession at all ; but if space is supposed to be finite and re-entrant on itself, like a kind of sphere, a very remote object in that case would show a spectrum in which the lines were not of the wave-lengths we expect them but were all displaced so that all the wave-lengths would seem bigger. We are used to such displacements, and our regular interpretation is that the object is going away from us. But it may be that the spiral nebulæ are merely informing us that they are so remote that space itself has suffered a change.

THE GALAXY

The description of these lesser and greater orderings among the stars leads up naturally to the question—What is the *Milky Way* ? Even the unaided eye shows it to be a central feature, and a proof that a system of some large kind exists. More careful work, as by star counts, and the distribution with respect to it of characteristic objects, confirm the fact. Still it has proved extremely difficult to assign a position to it, in any general order. If we give here with some confidence the views that appear to be prevailing, they must be read as not yet wholly established. They are, on the whole, greatly more enlarged than would have been acceptable a few years back. If this implies trusting to some perhaps uncertain ground, it must be remembered that all the indications point in the same direction, and that again and again, from the earliest times when Aristarchus made the Sun only five times the diameter of the Earth, astronomers have been forced to expand their conceptions, on a better knowledge of the facts. Perhaps this note of caution may convey too much doubt to those not used to the methods of astronomers. All that is given summarily below is the view of students of the problem of many years' standing, who are almost as good judges of a forecast as of a proof, and moreover much that it contains has been proved up to the hilt.

The *Milky Way* presents large ill-defined features which do not offer any easy clue. It is very different in brightness in different parts. One decided condensation has the dignity of a constellation—*Scutum Sobieski* ; the brightest part is in *Sagittarius*; for a great part of its circuit round the sky, it is split in two by an immense dark lane. The stars into which Galileo confidently and correctly resolved it prove, upon scrutiny, to be excessively small, so small as to reach the limit of separate detection with our present telescopes.

There are more and more of both visual and telescopic stars as we approach the *Milky Way*. On closer scrutiny, too, the condensation of stars towards the *Milky Way* proves to be only the beginning of the story. If we suppose that this greater number comes from looking into a greater depth, we conclude that it means that the stars around us are spread out in a sort of disc, with the Sun near its centre, or on the whole a little to the north of its central plane. Call this disc-like extension the " local cluster," or as it is sometimes named " the Kapteyn universe." We find that the clustering does not extend beyond a distance we can put roughly at 1,000 light-years, after which we have nothing like reached the main *Galaxy*. Moreover the central planes of the local cluster and the *Galaxy* do not agree. The local cluster is inclined at about 12°, which is more than one-eighth of a right angle, to what is estimated as the equator of the *Galaxy*.

In these circumstances one must look elsewhere than to the local cluster, large as it is, for a parallel, and the *Greater* and *Lesser Clouds of Magellan* naturally invite examination. Fine photographs of these grow more and more impressive the more one knows. The " clouds " themselves are well defined patches upon rather blank parts of the sky, made up of countless systems of individual stars, groups, clusters, and spiral nebulæ. Recalling what great organisms the spiral nebulæ are, it is no wonder the *Clouds of Magellan* have been called " Island Universes." Since Cepheid variables have been found among their members, the extraordinarily fertile method of the period-luminosity relation, which has been referred to already in connection with the distances of the globular clusters and the *Andromeda* nebula, has told the actual distances of these clouds. We find in consequence that the faint stars that are apparently of thirteenth magnitude are in reality super-giants that, at ten times the distance of *Sirius*, would exceed it in brightness. The enormous distances of 112,000 light-years and 110,000 light-years have been assigned to the two clouds, with diameters 14,000 and 7,000 light-years respectively. They are separated by 40,000 light-years from one another and are widely separated from the plane of the *Galaxy*.

Yet great as these systems are, consideration of these figures shows, as has been said, that if they are island universes the *Galaxy* itself is a continent. No direct measure of its span has been found, but indirectly the globular clusters, which are associated with it by symmetry, give a clue both to its size and its centre. The centre of the system of globular clusters is in *Sagittarius*, where the *Galaxy* is brightest, and where there is an immense condensation of stars, the brightest part apparently hidden from us by one of those dark patches that make the " lanes " and are associated with the local cluster. Now the distances of the globular clusters were among the first fruits of the method of Cepheid periods. And several pairs of these clusters are separated from one another by a quarter of a million light-years and upwards. Hence we shall have the right scale of ideas in thinking of the *Galaxy* as 300,000 light-years in diameter. If we want something to compare with this, we must look elsewhere than in the

Andromeda nebula or the *Clouds of Magellan*. We must search for super-systems, very remote of course, and including within their borders a multitude of great systems reduced to faintness by distance.

Such super-systems have been found and, what is more, the energy and thoroughness of Shapley, who first determined the distances of the globular clusters, and who is still at work upon the problem, have searched, to demonstration, what they contain. We can give some idea of the grounds. For example there is a somewhat insignificant patch of a few square degrees on the sky, crossing the constellations *Coma* and *Virgo*, which shows on a photograph of long exposure a large number of faint spirals. The actual number brought under examination is over 2,700. Their condensation in groups, their apparent diameters and other features have been examined, and in particular the distance that must be assigned to the collection. No variables are available for this purpose. The distance is estimated by comparing the appearances presented in the system with those of the *Andromeda* nebula and other systems for which, being less remote, the argument from observed variables is offered. The estimation is a matter of delicate judgment, but for our purposes not less reliable for that reason. The diameter arrived at for the super-system is two million light-years. The distances of the separate clouds differ widely, from eleven million to 150 million light-years.

It is evident then that we must treat this insignificant patch of faint objects as a super-system comparable with our own *Galaxy* and indeed exceeding it. Others have been found which are even greater and more remote, and the discovery for the present is terminated, not by want of material, but by the feebleness of our telescopes. But it is sufficient. We might get more detail, but we should not vary the view, which really answers the question with which this section began—What is the *Milky Way*? We must regard it, not as one system, but as a group of star clouds, which are collected in a flattened form, neighbouring and presumably influencing one another, though at immense distances, and each one of which might be called a universe. Our own local cluster, the "Kapteyn Universe," may be a degenerate spiral, to which in size it appears to belong. The nebulous appearances of these spirals seem to be only a result of the great distances at which they are seen. In that case, the dark nebulosity that hides so much of our sky would be interpreted as one of the dark bands that appear along the central planes of many of the spirals.

If this is the correct point of view, our local system is nowhere near the centre of the great *Galaxy* of which it forms an element, rather it is near the rim. All considerations point to a centre near the star cloud in *Sagittarius*, distant from us by say, 100 million light-years. And any apparent motion in the other parts, so far as it can be brought under one head, should more properly be attributed to our own system, than to the greater system with which it is compared. From this point of view the so-called rotation of the *Milky Way* should be regarded. Difficult as it is to treat, very definite and consistent results have been obtained, and these show that the local system and the great *Galaxy* are in rotation relative to one another and would turn completely round in a period of the order of 100 million years.

Under the imposing name of Cosmogony we consider *How Things Came To Be*. Really this is no part of an astronomer's obligation, but possessing curiosity like other people, he is interested in it. Yet before saying what can be said about it, one should in fairness indicate how large a proportion is of necessity inference. To describe the evolution of an organism is synonymous with giving its history. This can be done with some certainty in such limited fields, for example, as the meanings attached to a word in the language, let us say the word *post* or *humour*. But it is a very different matter to give the history of a natural object. Even in a case where the evidences are abundant, as for the human skull, often the best that can be said of a theory that connects them is, that it cannot be disproved. In astronomical matters we are on even weaker ground. The periods of time that must be considered are so vast, that in a quite literal sense we know only one point of the history and must infer the whole past and future. It is true that in many regions there are a great many examples which we assume to show different stages in a common succession, as we can infer the course of human life from the infant, the boy and the man, without watching the one develop into the other. But experience in the regions of Natural History, with its missing types and conflicting remains, does not encourage optimism or even confidence.

Yet, speaking first of the Solar System, some common connection is evident; in fact, if put in mathematical form as an estimate of probability, the evidence is overwhelming. The greater planets and nearly all of the host of minor planets move round the Sun, near to one and the same plane and in the same direction. There is no process in operation to make them do so, for the comets, which are also members of the solar system, do not. We may reserve the discrepancies shown by the new planet *Pluto*, until we know more about it. The alternative to plan is chance, but it is easy to see that the probability against such a coincidence by mere chance is overwhelming. How then did this evident system originate? Up to quite recent times the usual answer was contained in Laplace's Nebular Hypothesis, of which Poincaré said in the nineties that, considering its age, it didn't show too many wrinkles; though a little later Sir James Jeans remarked that the difficulty of disproving it was the same as that of proving anything definite about it—an ominous dictum for a cosmologist. This hypothesis supposed that both Sun and planets were formed out of a single original gaseous nebula, contracting on itself, rotating faster, as it would, and flattening out in the process. The planets were formed out of rings shed off in succession and collected into single bodies, while the Sun was the residue that remained at the centre. Under cross-examination, the answers of this theory to such questions as why do the planets rotate in the same direction as they revolve round the Sun are so unsatisfactory that as a theory it has been abandoned. It may perhaps apply elsewhere, but not to the solar system. But it has been no easy matter to find an alternative. Indeed there is only one that is current to-day, and that depends upon an *If*.

In place of imagining the planets to have been formed in a process of contraction which finally left the Sun in the middle, the Sun is imagined as formed first without planets. It would have remained without planets great or small unless it had experienced, once in its history, some great cataclysmic disturbance. The nature of this disturbance is supposed to have been tidal. All tides have the same character, which can be readily understood. An external body, like the Moon, attracts the Earth. The first effect is shown in a revolution of the centre of gravity of the Earth about the common centre of gravity of the Earth and Moon. But there is a secondary effect which shows itself in an elastic deformation of the solid earth and its atmospheric and aqueous envelopes into elliptical shapes, which follow generally the position of the Moon. The last of these, which gives the tides in the ocean, is familiar, but the others have been verified too. In the case of a more labile body than the Earth, and a greater disturbing body than the Moon, the tides might rise to any height. They might form an immense jet directed generally towards the disturbing body, which ended by breaking into drops, which never fell back upon the parent Sun at all, but had sufficient motion conferred upon them by the disturber, before it passed, to ensure their revolution in orbits. This is the tidal theory of the genesis of the solar system. It would explain how the planets all were near one plane, which the Ancients knew and designated by the Zodiac ; it would explain why they all go round the same way, and, if we suppose the disturber to have passed near by in the direction in which the Sun was rotating, it explains also the agreement of the Sun's rotation with the revolution of the planets. Things which it leaves to be cleared up are the near approach of the planetary orbits to circles, and the exceptional but definite presence of satellites which are *not* circulating in that way. But the difficulties of finding any explanation are so great that one is inclined to hope that a way out will be found. It may reasonably be said that we cannot expect a theory to explain every detail.

The disturbing body must of course be imagined as a star, and here arises the great difficulty of the theory. For tidal effect, proximity is more important than mass. The Sun produces on the Earth only half as great tides as does the Moon, though it is twenty million times as massive—because it is four hundred times as far away. The passing star would have to make its closest approach to the Sun at much less than the Earth's distance. Now the first fact about the stars is their isolation. It is of course not impossible that in the remote past a star passed near the Sun. The chance that one might do so can be estimated. The result is unfavourable. Unless a perfectly immense period of time is allowed, the chance against the approach of a star sufficiently near to bring the planetary system into being is as overwhelming as is the evidence that the system did not originate by chance. This does not quite demolish the theory. The latest views are inclined to leave open immense lapses of time, in which things may have happened, and there is always the chance that an off-chance comes off. But it is not convincing. It may be that this theory does not need very much adjustment. Theory shows that the normal development of a rotating star leads to fission. A body originally spheroidal develops into an elongated ellipsoid, then into a pear shape, then into a shape like an unequal dumbbell or gourd, and finally breaks into two parts which recede from one another. This break could hardly be a clean one, and would result in the formation of a not very regular set of drops that would be endowed with orbital motion. Some of them would form planets round the one star and some round the other. This would abolish any question of the genesis of our system as the consequence of a very improbable coincidence. Incidentally it would make a planetary system the possession of a great many suns.

As there are so few tenable theories of cosmogony, we may glance again at the nebular hypothesis, in a connection where at any rate it has not been disproved. It seems, in many respects, to fit in with the history of spiral nebulæ. Laplace imagined a primitive nebula which was gaseous. It is very doubtful if the great spiral nebulæ are gaseous. They do not show the spectrum of a gas, and under high resolving power their gaseous appearance shows signs of breaking up into stellar points. But if we suppose them to be collections of rotating gas, it can be shown mathematically that we should have a sequence of states which appear to be illustrated in the sky—nearly spherical forms, becoming elongated ellipsoids under greater condensation with its more rapid rotation, then breaking out along the equator with streams of escaping, and presumably cooling, and therefore dark, gas. These dark equatorial bands appear to be characteristic of the course of development. Indeed it is conjectured that the " dark nebulæ " that obscure so much of our own sky, and are associated with the local cluster, are of that kind. This would make our " local cluster " nothing but the stars into which a parent nebula has broken.

It is true that spiral nebulæ develop in two great whorls of stars, arranged in a geometrical shape, and we are at a loss to assign any reason why this should be a regular event in the history of a rotating gas, such as Laplace imagined. But a great many features fit, and we may end, not by rejecting Laplace's Nebular Hypothesis, but by promoting it to an application far vaster than he dreamed.

One word may be said in conclusion. Every astronomer has had occasion to learn that people are more interested in the origin of life than in that of the planets upon which it may be supposed to exist, or the stars of which these may be the offspring. He may be excused for waving such questions aside. It is not his affair. Our life exists under very narrow limitations, which hardly touch astronomy. The astronomer cannot point to any other place in the universe where life, as we know it, could be supported. In short, anyone can judge the question as well as he.

PROGRESS AND DECAY

The use of these popular words to summarise the present section is deliberate. But before science can say anything about them, we must first strip them of the moral attributions that lend them nearly all their attraction. If this is done, we recognise in nature two kinds of process, *prima facie* fundamentally different, and must enquire what is the real distinction between them. The first process goes on, so far as appears, without change of type, for ever. There are innumerable examples, of which we need only mention, on the large scale, the motion of the Earth round the Sun, and on the small one, that of an electron round its nucleus in an atom. The second kind progresses towards some ultimate state. Again the examples are so easy to find, that this process was thought of, up till yesterday, as a summary of Nature. The diffusion of motion, the diffusion of heat, the degradation of energy are commonplaces to everybody. If asked what was the purpose of life, you could answer in one word —death. But science has nothing to do with grim or emotional colouring—what we wish to determine is, whether there are indeed two kinds of process, or only one—whether we can assign an end towards which things travel, or whether they continue in changing figures of one endless dance for ever.

One alternative, which will suit some of the cases, is to suppose that the things that go on for ever are really an ultimate state in which the element of change has exhausted itself. Consider, for example, the system of the Earth and Moon. The Moon's rotation occupies the same time as its revolution round the Earth. It can be shown that this would follow from tides which the Earth would raise upon a Moon when the latter was in a plastic state. And in the same way the friction brake which the tides apply to the Earth's body will infallibly slow the day down till first it is equal to the month and ultimately to the year, producing at the same time other changes in the orbits, until finally all sleeps in one unending night —*nox est perpetua una dormienda*. But though that might do for the Earth and the Moon such a history would not fit the atom at all. As far as we know, the quantised states, as those states of the atom are called which operate by the gain or loss of a quantum, shift back and forth without a trace of decay.

One may think, on the other hand, of the uncompensated outflow of radiation from a star. Briefly the current description is this :—intense relative motions within the star convert its matter into radiative energy, which soon or late escapes from the surface and travels away through space for ever, producing almost infinitesimal mechanical or thermal effect that might possibly return. Even here we must be cautious. We have learnt that while the " temperature of space," *i.e* the temperature of any absorbing matter there may be, which results from such radiation, is a few degrees only above absolute zero, the conclusion is profoundly modified if atoms are met with that are capable of *selective* absorption ; the resulting " temperature " of such an atom may be far higher than that of the emitting body. Still we can hardly say that this modifies our view by much. The four million tons of its mass a second which the Sun converts from matter to energy, and pours out as radiation, is gone for ever and will not be replaced in any shape or form. We have to accept as typical of at least one side of our system a process which goes on in one direction only and cannot be reversed, and which leads as a limit to a state in which no further exchanges are possible.

This is the well-known doctrine of the degradation of energy, which was more readily received before modern physics established itself. Modern physics has disestablished so many accepted ideas in the course of establishing itself that it becomes necessary to re-examine the idea of the degradation of energy. Regarding heat as nothing but irregular motion of the molecules, it becomes essentially a question of the diffusion of motion. Now if anything is diffused or distributed, let us say by chance, the state which we are most likely to find is the state that contains the greatest number of equally probable arrangements. Suppose then we start with an unequal distribution, such as one end of a bar hot and the other cold, this might be called as probable as any other distribution, and so we might expect to find it at any subsequent time. But we do not. On the contrary we are sure to find that the temperature has equalised itself throughout the bar. Now it may be said that an exactly equal temperature throughout the bar is just as improbable as the state from which we started. That may be. But the cases that would *pass* for equal, by any tests we can put, are so enormously more numerous than any other state, that practically we find nothing else. Modern physics says nothing to rebut this argument. Therefore it remains ; and it is a typical case of the degradation of energy.

Be it remarked that we invoke in this discussion nothing but " chance "; it implies no intelligent guidance. Maxwell imagined a method of reversal of the " second law of thermodynamics," which is just a statement of the continual degradation of energy ; he imagined " demons " watching the separate molecules, and separating those that were moving fast from those that were moving slowly by opening trap doors to let them pass. The result would be the same as arranging that a bar should, of its own action, make one end hot and the other cold. But these demons must have been intelligent. The task of physical science is to show what follows in Nature, apart from intelligent guiding.

But what is the source of the tendency, always working in one direction, that gives us first hot concentrations of matter like the stars—depositories of stores of energy that thereupon dissipate themselves as rapidly and completely as the circumstances allow ? It is simply the unidirectional character of gravitation, which collects all matter into a centre, unless it is endowed with sufficient lateral motion to ensure the description of an orbit. At the centre, exchanges of motion take place by collision, and we have the concentration of heat and ultimately its diffusion. In the atom we have both positive and negative electricity, with attractions and equal repulsions. But in gravitating masses we have attractions alone. Necessarily so, for if we suppose that any stuffs that repel one another exist, they would mutually drive one another away until the field contained one kind alone. Say we are left with that kind of attracting stuff, and call it matter, then the familiar degradation of energy, with its terminus in what is known as a " heat death "—though not a death of motion, as far as motion persists in orbits—becomes inevitable.

In somewhat the same way as the Moon's orbit remains after all its heat-motion is radiated away, while it is now believed that a star is continually transforming its mass and dispersing it as radiant energy, there will remain from this process an inconvertible residue of dead matter such as we see in the Moon, for which there is no more prospect of further conversion than there is for a conversion of a residue of orbital motion. Unless again this dead residue, whether matter or orbital motion, is ultimately dissipated by bombardment by cosmic rays.

THE TIME SCALE

We touch the universe at a single point of time. Apart from memory there is no such thing as a past. Even if we include memory and supplement it by records that can be called scientific, the time is so brief in which anything definite has been known of the heavens that we hardly need to modify the above exact statement. An astronomer, therefore, might decline to speak about what is not before his eyes. And there is the further complication—that must not be treated as of no practical importance in relation to the universe—that simultaneity and the time sequence possess no common meaning for different minds. If we speak of the history of things, it is evident that we must do so in a conventional way. We are divorced from direct observation of the history of any individual object, and must rely upon recognising, among the diverse objects presented to us, specimens of successive stages through which the individual has passed. He may make a mistake in doing so. The manner, the order, even the members that are selected by his theory, will depend upon the theory he adopts. The ground, therefore, is uncertain. But the astronomer is in no worse case than any other naturalist, and better placed than many. In any case, with the proviso that the picture is conventional, theoretical, and must not be taken too seriously, it will aid the comprehension of what has been written if we add here some account of how long the order of things we see has taken to come about and how long it may be expected to endure. The account will be very brief, for the agreement among astronomers, such as it is, is rather rough.

The age of the Earth is about two thousand million years. In making the statement we recognise that it rests upon an element of observation and an element of theory. It is an inference, and its reliability depends less upon the question of making the observation correctly—for this may be revised and refined—than upon being able to say that the theoretical process has continued at an unchanged rate through that great lapse of time of which we have no experience. It is evident that this objection will envelope in doubt any such measure of the Earth's age as the rate at which the salinity of the sea increases. Much more satisfactory is the rate of degradation of radio-active materials. Radio-activity is an atomic process which neither heat nor pressure nor any other force that we know can either hasten or retard. In this way, uranium degenerates into lead. The physicist can distinguish the lead which resulted from the break-up of uranium from other lead that is indistinguishable from it by chemical tests. In certain rocks, uranium and its degenerate lead are found, and if we assume that the process has gone on at the same rate since the crust of the Earth was first formed, we arrive at an age of one or two thousand million years. Other indications confirm the figure. Strictly it refers only to the formation of the crust, but if the genesis of the planets that has been exposed in an earlier section is accepted, the Earth must first have existed as a glowing liquid drop of the Sun's body. But when direct communication of heat to this drop was broken, and it lay open to radiation into cold space, it seems reasonable to conclude that a crust of rock would be formed in a time that was a negligible addition to the age that has been mentioned.

It would follow that the other planets have the same age. We have no means of estimating directly, but it is probably significant to point out that small bodies like the Moon and *Mars* seem to have had less power to conserve their original state than the Earth, while great ones like *Jupiter* and *Saturn* have degenerated less

The age of the Sun must be estimated with the same cautions in mind. We must have an observation of the present rate of some process, and an adequate theory by which we can go back into the remote past until we arrive at a state that can be called primitive. The most satisfactory theory is that which connects the mass and luminosity of a star. Derived originally as pure theory, it has proved to apply closely to the luminosity of all stars of known mass. We have therefore only to fit it on to the present mass and the present luminosity of the Sun, and we obtain with some confidence a picture of the latter's previous history. If we do so, we find that at the time when the planets came into being, the Sun was much as it is now, but if we go back to a million million years and beyond, it becomes a different story. Radiation diminishes the mass, and the theory shows that a greater mass gives greater and continually greater radiation. From the greatest stars there is a torrent of radiation that reduces their mass at headlong speed. Before we reach backwards to eight million million years, the Sun would have had a mass equal to that of the greatest star known.

Having gone so far in theory, it is tempting to go further. But we must recognise that the ground becomes more and more questionable. We have before us stars in various states of development. Consider a giant star such as *Betelgeuse*—the Sun may have passed through a similar state, but what was *Betelgeuse* itself at that remote period ? We cannot point to any object known as an answer. At least it seems certain that the stars did not all come into existence simultaneously, as we suppose the planets to have done.

More precarious still is anything we can say of the past history of still greater organisms such as the spiral nebulæ, and in an outline such as the present, where the attempt has been made to show the grounds of confidence as well as to state the articles of an astronomer's belief, we may fitly refrain from pursuing the speculation.

BIBLIOGRAPHICAL NOTE

Astronomical knowledge has advanced so rapidly that a few years place a book out of date. The following list is therefore brief.

An excellent and authoritative work, giving details of phenomena, measures, and reasoned theory is

RUSSELL, DUGAN and STEWART : *Astronomy* ; 2 vols. (Boston. 1926, 1927)

A general reader and a specialist will be equally at home in it, and it contains current references to all the previous literature.

Recent works, conceived on more popular lines, are :

SIR A. S. EDDINGTON : *Stars and Atoms* (Oxford. 1927)
G. E. HALE : *Beyond the Milky Way* (New York. 1926)
G. FORBES : *The Wonder and the Glory of the Stars* (London. 1926)
H. SPENCER JONES : *General Astronomy* (London. 1922)
W. M. SMART : *The Sun, the Stars and the Universe* (London. 1928)
J. S. DUNCAN : *Astronomy* (New York. 1927)

A work that is too well written to be called out of date is

SIR A. S. EDDINGTON : *Stellar Movements and the Structure of the Universe* (London. 1914)

This work is for mathematical readers ; so is also the same author's *The Internal Constitution of the Stars* (Cambridge. 1926)

A striking recent work is SIR. J. JEANS : *The Universe Around Us* (Cambridge. 1929) ; and a continuation by the same author—*The Mysterious Universe* (Cambridge. 1930). These books embody statements that in some places are still matters of opinion, but they are the more interesting and, to the right readers, not less weighty for that.

For those who are interested in the history of the subject we may mention

A. M. CLERKE : *History of Astronomy in the Nineteenth Century* ; 3rd edn. (London. 1898)

G. FORBES : *History of Astronomy* (London. 1909)

and for details of the lives and theories of earlier astronomers

J. L. E. DREYER : *Planetary Theories from Thales to Kepler* (Cambridge. 1906), and

A. BERRY : *A Short History of Astronomy* (London. 1898)

Finally should be mentioned

H. SHAPLEY and H. E. HOWARTH : *A Source Book of Astronomy* (New York. 1929)

which contains extracts, translated where necessary, of passages from the works of original discoverers from Copernicus to the present day.

THE NATURE OF MATHEMATICS

By

JAMES RICE

SYNOPSIS

Introduction : Mathematics and the practical needs of Man — Mathematics as distinct from the arts of calculation and mensuration — The contributions of the Egyptian, the Greek, the Hindu and the Arab.

Number : The laws of numerical operations — The Commutative. Associative and Distributive laws as applied to numbers — The use of the plus and minus signs and of brackets — Algebraic symbolism — Integral numbers — Fractional numbers and Decimals — Irrational numbers — Positive and negative numbers — The generalisation of the meaning of number related at every step to the practical activities of Man.

Algebra : Problems and algebraic symbolism — Formulæ — The fundamental laws of algebraic operations — Factorisation of algebraic expressions — Algebraic symbolism is no mere " shorthand " — Logical and mathematical principles — Equations — The origin of the name " Algebra " — Methods of solving a quadratic equation and the duality of the roots — Equations and practical problems — Imaginary numbers — Generalisation of the idea of a " power " of a number — Algebra beginning as generalised arithmetic becomes a weapon for dealing powerfully with the variable quantities of natural phenomena — Functionality.

Geometry : Extension of bodies in space — Surfaces, lines and points as abstractions from the real properties of bodies — Geometry concerned with such abstractions — Euclid's great treatise : a brief summary of its contents — Axiom and Postulate — Construction and Proof — The famous Euclidean postulate as to parallel lines — The dependence of his conclusions on the truth of this postulate — Digression on the actual experimentally observed facts of our physical space.

Limits, The Calculus, Periodicity : The notion of a limit as suggested by observation on moving bodies — The world as a flux of events and not as a static configuration — Differentiation : its importance for the laws of Physics — The notion of length as applied to a curve — Integration — Convergent and Divergent Series — Trigonometry and Periodic Functions.

THE NATURE OF MATHEMATICS

INTRODUCTION

The study of the sciences originated in the practical needs of men, and Mathematics, though the most abstract of the sciences, offers no exception to this statement. We can see the beginnings of arithmetical calculation in the primitive requirements of the race, when men bartered articles with one another or divided their prey into portions, and perforce had to be able to count so as to maintain a rough justice in their division or exchange. In more settled conditions, when the tilling of fields became the vital activity of a tribe instead of hunting, the necessity of dividing the cultivated area into suitable portions for each family of the tribe compelled them to develop some elementary notions of mensuration. Nowadays, when the word " mathematics " is mentioned, the first idea to arise in the mind of the average man or woman in this connection is linked with the art of arithmetical calculation or skill in solving geometrical problems. It is true that education in our schools is developing so far that the subject of algebra probably presents itself to the hearer's mind as well as trigonometry and calculus. But to the average boy and girl with a good secondary education algebra is still " generalised arithmetic," in which the calculations are carried out with letters instead of " real numbers " ; trigonometry is a kind of mixture of algebra or arithmetic and geometry ; and calculus is a peculiar pursuit that " looks like " algebra, but differs in one strange operation which can be technically mastered with sufficient practice and assiduity, but still remains somewhat of a mystery both as regards its reason and its purpose. Hence, despite all our sophistication, " mathematics " as a name conjures up notions which are clearly related to " arts," rather than " sciences," the cultivation of which was one of the prime needs of man the moment any form of communal life, based either on food-getting or food-producing, came into existence.

We have no record indeed of those early geniuses of our race who first recognised the difference between " one," " two " and " many," who then proceeded to subdivide the " many " into " three," " five," " ten " and so on, and who realised that the number of fingers on one hand or on two and the number of toes on the feet were an extremely convenient piece of machinery for help in counting ; or who gathered flints or pebbles and laid them down, one by one, to indicate to their fellows the number they wished to convey and then, recognising the clumsiness of these methods of communication, invented sounds and signs to convey to the hearer the idea of the number in question at the moment. But after all, mere counting lacks the special character which makes arithmetic one of the mathematical sciences and the most fundamental of them. It is hard for us to realise the immense stride in human thought which carried us from counting to the study of " number " in itself as an object of interest, when we began to realise that six pebbles, six arrows, six men, six trees had something in common which is neither pebble, nor arrow, nor man, nor tree, that something being just " six " itself ; when it dawned on the human mind that numbers had an interest of their own apart from *numbered objects* and presented a uniformity of behaviour in all circumstances of counting which is the very characteristic of all facts capable of being scientifically summarised. That six sheep and four sheep made a collection of ten sheep, that six pebbles and four pebbles made a heap of ten pebbles, in fact that six and four *always* " made ten " no matter what objects were involved, was a scientific generalisation which must have cost some primitive Newton much mental travail and earned him the admiration and reverence of his less gifted fellows. We may presume that he was a priest or medicine man. When we come to the civilisation of the Egyptians and the Babylonians, the records show that such purely intellectual pursuits were the special province of the priestly caste. But even in these great states, with all their wealth, refinement and pomp, the real nature of mathematical knowledge was not discerned. This statement can be brought home to the reader by a simple illustration. Mensuration was a necessary art for the Egyptians. The rise of the Nile annually wiped out all the landmarks which divided field from field in the arable land which fringed its banks. When the river receded, fresh division of the soil had to be undertaken among the various tribes, and so a considerable body of mensurational propositions became known in an empirical way, *e.g.* how to find the area of a triangle. But to the Egyptians this was all " earth measuring." Apparently the desire to know something about form and figure, apart from particular fields and *as something distinct from any material thing*, never arose in their hearts. It was the Greek who first made that great flight of spirit, although he modestly kept the Egyptian name " geometry," which means literally " measurement of the earth," for a mental discipline which is as unlike the Egyptian prototype as a symphony is to a folk-tune. Again, the Egyptians had their skilful builders of pyramids and temples, and one of their stock-in-trade implements was a rope divided by knots into twelve equal lengths. With this they could make a triangle of sides 3, 4 and 5 units, and they knew that between the short sides there was included a right angle. But it was a Greek, and not an Egyptian, who thought about right angled triangles in themselves apart from strings, ropes and special sizes, and discovered the great proposition about the square on the hypotenuse being equal to the sum of the squares on the short sides. The average man probably does not realise that this proposition, the discovery of the famous Pythagoras, enters decisively into all our ideas about the nature of physical space and, with its modern extensions, forms the starting-point for introducing any method of measurement at all into that child of modern thought, the space-time of the relativist.

The love of knowledge for its own sake amounted to a passion with the Greeks in the golden age of their history, and so it is but natural to find the early developments of Mathematics in the proper sense of the word as one of the manifestations of their genius. To them number was an absorbing topic quite apart from skill in calculation or the special properties of numbered articles ; and the general laws of form and figure exercised their intellect quite apart from the material bodies which presented to them the infinite variety of shapes with which we are familiar in daily life.

The word " Mathematics " is found in Greek literature at the time of Plato, but not specialised to the meaning it acquired later. With that great philosopher *mathema* (literally " a thing learnt ") means any subject of instruction or study. Yet he does say in the *Laws* that three subjects are specially fit for free-born men ; they are arithmetic, the science of measurement (meaning what we now call geometry), and astronomy. His emphasis on these three subjects gradually led to a specialisation of the word *mathema* to these and similar objects of study, so that in the time of Aristotle the convention had so far hardened, that his followers explained the particular use of the word by pointing out that subjects such as rhetoric, poetry, music or literature could be understood even by one who has not learnt them, but that the subjects grouped by them under the name *mathemata* could not be known by anyone unless he had received a definite course of instruction in them. The word *mathematike* appears to have first come into use in the time of Pythagoras a century and more before Plato, and seems actually to have had, with the Pythagoreans, some of the specialised meaning definitely assigned to it by common consent later ; be that as it may, by the time of Aristotle the term *mathematics*, meaning literally " things fit to be learnt," had definitely established itself as referring to the subjects such as arithmetic, geometry, astronomy, optics, etc., which were regarded as above all others the things in which it was most suitable for a cultured man to receive instruction.

So clear were the minds of the Greek thinkers on these matters, that they used entirely different words to distinguish between these lofty mental exercises and those mere arts and practices of daily life and business which had some connection with them. Thus Plato uses the word " arithmetic " to mean what is commonly meant by it to-day in any school curriculum, but a different word " logistic " to denote the art of calculation. Thus he would have referred to " lightning calculators," and those who can tot up columns of figures with speed and accuracy, as men who are " logistic " by nature, but he would not have called them " arithmeticians " unless they had shown themselves capable of studying and grasping the true theory of number, as distinct from calculation. He did not despise *logistic*, for he admitted that naturally slow people would be made smarter by it and that it was a very necessary accomplishment in daily life ; but he would have regarded the acquisition of the art of calculation only as a preparation for the study of the true science. Similarly in the time of Aristotle, a clear distinction was drawn between " geometry " and " geodesy," the former being geometry in our sense (though showing its origin in its name, " earth measurement "), the latter being what we should call " mensuration," meaning not only land-surveying but all practical measurements of length, surface and volume. Aristotle seems to have been the first to indicate a division in Mathematics which is acknowledged in school and university curricula to this day, namely, the separation of the general science into two branches, " Pure " and " Applied." Thus he refers to Mechanics, Optics, Harmonics and Astronomy as the more physical branches of mathematics, pointing out that the proof of propositions in these subjects depends on the pure mathematical subjects, Geometry and Arithmetic.

Although we derive our names for Arithmetic and Geometry from the Greeks, we must not forget that the Hindus independently cultivated these subjects, and it is from the Hindus that we derive our present numerical notation. The forms 1, 2, 3, etc., for the numbers are our copies of a variety of symbols used by the Hindus in their writings, and have in modern times replaced both the Greek method of using the letters of their alphabet for this purpose and the clumsy Roman numerals I, II, III, IV, etc.

So far we have not mentioned Algebra, the third of the trio of subjects whose names leap to the mind of the ordinary man when the word " mathematics " is mentioned. Most people know that Algebra is a kind of arithmetical calculation, where symbols such as the letters of the alphabet take the place of the symbols such as 1, 2, 3, etc., which designate actual numbers. The word " algebra " is Arabic in origin, and makes its first appearance in a work by an Arab mathematician, Al Khowarazmi, in the ninth century A.D., but of course the operations in Mathematics which we call " algebraic " are much older and date back, in a rather rudimentary form, even to the Egyptians. A Greek, Diophantos of Alexandria, wrote the first Western work on it about the middle of the fourth century A.D., and actually the Hindus had brought this subject to a higher pitch of development than the Greeks, whose peculiar genius was more at home in Geometry. It was from the Hindus that the Arabs learnt this system and brought it to the West. In the solution of equations, there is a well-known operation in which quantities on one side of an equation are brought over to the other side with a changed sign. This transposition was considered to be a reunion of separated quantities and was regarded by the ancients as an operation of great importance. When the Arab, Al Khowarazmi, wrote his treatise, he called it " al-jabr m' wa'l muquabalah," the word " jabr " referring to this reunion. The word " muquabalah " referred to another operation in equations, where a symbol appearing on both sides of the equation with the same sign is taken away from each side. (" Al " is the definite article in Arabic.) In consequence, when this treatise became well known to European scholars in the middle ages, they referred to it by the first word in its Arabic title, corrupting this into our " algebra."

NUMBER

We have already realised that the first mathematician was he who thought of the number " three," for instance, quite apart from three pebbles, three bits of meat, three dogs, or three *of any particular thing*. This " emptying " of every physical property out of the counted things, except their mere existence as individual things, is an example of what the philosopher calls " abstraction." The primitive mathematician to whom we have referred was abstracting from the things themselves every quality except their capacity to be counted. For him it did not matter what three things were involved ; indeed they did not even need to be the same kind of thing—a dog, a tree and a pebble would serve as a physical picture of "three," as well as of the groups mentioned. He recognised that when he put *any* three things into a heap of any four things he always got the same number of things in the larger heap, namely seven. He did not find that four dogs and three dogs, for example, gave a group of dogs whose number was different from the number of pebbles he obtained when four pebbles were placed beside three pebbles. The apparent triviality of these illustrations must not be scorned, since they are vital to the understanding of the scientific process we call "generalisation." Recognising this feature as true of all additions of heaps or groups, he gradually began to think of the addition as not being effected on the groups *but on the numbers*, and so he arrived at the "identity"

$$4 + 3 = 7$$

We are using modern symbolism, of course. The ancient and mediæval people wrote that result with different symbols, but essentially it was numbers which they added and not *things*. The numerals 3, 4, 7 are modern adaptations of Hindu signs; + is a symbol which did not come into use until the fifteenth century; and the two parallel strokes =, representing "is equal to," are also of recent origin. The reader should bear in mind that in every case our symbolism is most unlike the symbolism of the Greek, the Hindu, the Arab or the mediæval European, but that the processes indicated by the symbolism are alike.

Another thing which this acute observer of distant ages noticed was, that when he put a group of four things beside a group of three things he had the same number as if he put a group of three things beside a group of four. Again this looks terribly trivial but it seems to bring out the correct use of the sign +; we nowadays write down this result in the form

$$4 + 3 = 3 + 4$$

The left side reads "four plus three" and means the result of adding three to four; the right side reads "three plus four" and means the result of adding four to three. As the result is true when any other pair of numbers is substituted for 3 and 4, we write the general result thus:—

$$a + b = b + a$$

and the reader at once thinks of algebra. Strictly speaking, this is not algebra. At present we are simply stating, in a more general symbolic form than we did above, that the result of adding any two numbers together is independent of the order in which they are placed. We use any convenient symbol (and experience has shown that the letters of various alphabets are the most convenient) to represent a number which we need not specifically state in numerical value. (This sort of device enters into many operations other than arithmetical. For example, chemists use a peculiar symbolism to state important results concisely and briefly. Thus *H* stands for a unit weight of hydrogen; *O* for 16 units of weight of oxygen; *Cl* for 35.5 units of chlorine and so on, some hundred or so of such symbols being tabulated in any work on Chemistry.) The mathematician has a word which he associated with the symbolic statement written above. He says that the operation of addition is "commutative." Take another of these apparently trivial statements. Suppose we wish to add 4 and 3 and 5. Of course the order in which we write them down is immaterial ; but as they stand it is also immaterial whether we add 3 to 4 and then add 5 to that result, or add 5 to 3 and then add that result to 4. We express this by writing

$$(4 + 3) + 5 = 4 + (3 + 5)$$

Here we have an example of the use of "brackets," as the curved strokes () are called. On the left side, the brackets enclosing 4 and 3 indicate that they should be added first and then 5 added to the sum ; while on the right side, the enclosing of 3 and 5 indicates that addition of them should be effected first and this sum added to 4. The mathematician again has a special word to suit this occasion. He speaks of a law of "Association," and he writes it entirely symbolically as

$$(a + b) + c = a + (b + c)$$

and of course, by his law of Commutation, either of these "expressions" is equal to $(a + c) + b$ or $a + (c + b)$ or $(b + c) + a$, etc. ; and finally, as this is so, he can, if he wishes, do without the brackets and write the complete sum as $a + b + c$, or $a + c + b$, or $b + c + a$, etc. As a matter of fact he can invent quite fiendish problems involving the use of brackets, as most schoolboys know, leading to dozens of pitfalls for the unwary ; but in general the errors into which the scholar falls are due to his failure to keep before his mind the simple meaning of the symbolism used.

The minus sign offers no difficulty in this connection. If we add 6 to 5, and subtract from this result 4, we express this in the most rigidly correct symbolic way as

$$(5 + 6) - 4$$

But, of course, we get the same result by first subtracting 4 from 6 and adding the result to 5, which is correctly written as

$$5 + (6 - 4).$$

Or we can find the same answer if we take 4 from 5 and add 6 to the difference, which is

$$(5 - 4) + 6$$

and so on. As all these are equivalent, the mathematician once more simplifies his symbolism somewhat by writing

$$5 + 6 - 4,\ 5 - 4 + 6, \text{ etc.}$$

according to his convenience or choice.

Take another example which raises one little point of considerable importance. Suppose we add 3 to 7 and then subtract this result from 12. In rigid symbolism this is

$$12 - (7 + 3).$$

Now will it do simply to “ wipe out ” the brackets and write this

$$12 - 7 + 3\,?$$

Clearly not; for one result is 2, and the second, which says “ subtrac 7 from 12 and then add 3 to that,” gives 8. In fact $12 - (7 + 3)$ turn out to be the same as $(12 - 7) - 3$, or $12 - 7 - 3$, which says “ subtract 7 from 12 and subtract 3 from that.” Again let us subtract 3 from and then subtract this result from 12. This is symbolised by

$$12 - (7 - 3)$$

and this is not at all the same as $12 - 7 - 3$, but is actually the sam result as $(12 - 7) + 3$, *i.e.* the result of subtracting 7 from 12 and *addin* 3 to the result. Thus, in more general symbolism,

$$a - (b + c) = (a - b) - c$$

and

$$a - (b - c) = (a - b) + c$$

so that, stated as a matter of routine, if we remove brackets before whic occurs the minus sign we must change the signs within. Of course th above expressions can be written respectively as $a - b - c$ an $a - b + c$; but as we cannot add or subtract many numbers “ all once,” but must group them in pairs at each stage, brackets are alway implied although they need not always be written. It is over this changin of the sign inside brackets preceded by the minus sign that the schoolbo is frequently so confused. For example, let us write down

$$16 - [10 - (5 + 3)]$$

Now strictly this means :— “ Add 3 to 5 and subtract the result from 10 take this result away from 16.” The answer is of course 14, and this is th same as

$$16 - [10 - 5 - 3]$$

and this again the same as

$$16 - 10 + 5 + 3.$$

In short, if one interprets the top expression correctly in words or cannot go wrong; but there is a purely mechanical way of removing th brackets one by one, *working from the inside outwards* and changin signs where necessary, so that

$$\begin{aligned} & a - [b - (c + d)] \\ = \; & a - [b - c - d] \\ = \; & a - b + c + d \end{aligned}$$

and

$$\begin{aligned} & a - [b - (c - d)] \\ = \; & a - [b - c + d] \\ = \; & a - b + c - d \end{aligned}$$

Trial with any actual numbers will always verify this.

We now meet another result which raises an awkward but very funda mental question. Suppose I write down

$$16 - (3 - 7)$$

This says " Subtract 7 from 3 and subtract the result from 16." This appears to be nonsense : you cannot subtract 7 from 3. But if a friend borrows £7 from you, and only repays you £3, he appears to have achieved the feat. He leaves you the poorer by £4. Indeed the natural exclamation (creeping into colloquial use to-day), " I was minus £4 on that deal," might rise to your lips. So if I write

$$16 - (3 - 7) = 16 - 3 + 7 = 20$$

conforming to the rule of changing the sign, I can think of it as representing the financial state of your friend who, beginning with £16 in his pocket, borrowed £7 from you and only repaid £3, thus " taking away " from his own little pile £(3 — 7) and yet being £4 to the good ! So it appears that such an expression as

$$a - (b - c)$$

need not be altogether nonsense even if c is greater than b, and that writing it as

$$a - b + c$$

may still be quite valid. With this hint we leave the point for the moment and will return to it later.

We are all familiar with the multiplication table and the meaning to be attached to 3 × 4 for example. Our primitive mathematician must have noticed the interesting fact that four heaps of three things gave the same number of things as when he put three heaps of four things together. As we write it, that result is

$$4 \times 3 = 3 \times 4$$

The left side reads " four multiplied by three," the right " three multiplied by four." In more general symbolism

$$a \times b = b \times a$$

or multiplication of two numbers is " commutative."

Actually, the cross sign × is frequently omitted *when we use letters to represent numbers*, so that the product $a \times b$ is more often than not written $a\ b$, and $b \times a$ written $b\ a$. We naturally cannot omit the cross when we use actual numbers ; for 34, for example, is thirty-four and not three times four, which must be written 3×4, or sometimes 3.4, the dot printed on the line sometimes taking the place of the cross. (The dot on the line must not be confused with the dot above the line, as in 3·4, indicating the decimal point.) This privilege accorded to letters, and not to the numerals, renders necessary a short digression here ; for if we actually did want to suggest that a number had two digits, the first one being a and the second one b, we should have to write it $10a + b$. This serves to remind us of the universal convention in the writing or printing of our numbers, that the last number is in the " unit's place," the one before that in the " ten's place " and so on, so that

$$356 = 6 + (5 \times 10) + (3 \times 100)$$

But this convention is not used in our symbolism of letters. Actually $a\,b\,c$ means that we multiply a by b and that product is then multiplied by c. If we wish to suggest a number of three digits whose first digit is a, second b, third c, we must write it $c + 10b + 100a$. Beyond that measure of caution in interpretation the omission of the cross causes no inconvenience.

Two very convenient abbreviations are used when, in addition or multiplication, the same number is repeated several times. Thus :

$$a + a + a + a + a$$

can be written $5a$, the economy in writing being obvious. Again

$$a \times a \times a \times a \times a$$

or $$a\,a\,a\,a\,a$$

is generally written a^5, the 5 being printed in small type at the top righ hand corner of the letter to distinguish the result from $a5$ which i actually the same as $5a$, as we know. We then speak of the 5 in a^5 as a “ index ” or “ power,” referring to a^5 in the words “ a to the fift power ” or “ a to the power 5.” Looking now at the four “ expressions ” ab, ba, a^b, b^a, we recognise that the first two mean the same number, bu that in general this is not the same number as either the third or fourt expression represents ; nor indeed do the third and fourth expression represent the same number ; a^b represents the result of multiplying a b a, and that product again by a and so on, until the number of a symbol involved has reached b, and b^a represents similarly $b \times b \times b \times\ .\ .\ .,$ times.

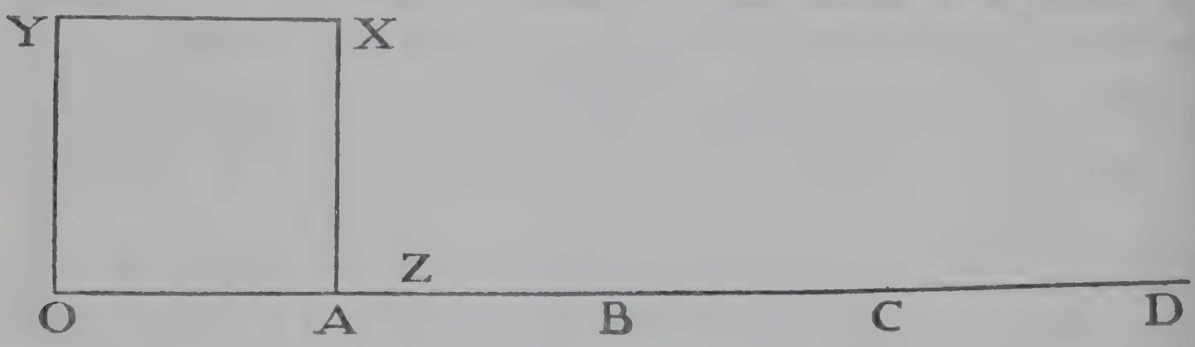
There remains the fourth fundamental operation of arithmetic, namely division. This is the inverse of multiplication, so that when we writ $4 \times 3 = 12$, we can also write it $12 \div 3 = 4$ or $12 \div 4 = 3$. Actuall the division sign, ÷, is frequently replaced nowadays by the “ solidus,” /, and the divisions above are often written $12/3$ and $12/4$. Of course th operation of division is not commutative ; for certainly $12/3$ is not th same as $3/12$. Indeed in confining ourselves, as we have implicitly don so far, to the numbers by means of which we *count discrete objects*, w have no meaning at all for $3/12$ if “ number ” is to refer exclusively t the numerals of the ordinary table. For that matter $12/5$ or $12/7$ woul have no meaning either, while $12/2$ and $12/6$ would ; so that if we ha no other numbers than 1, 2, 3, 4, etc., a/b might or might not have meaning, and even if a/b had a meaning, b/a would not. This introduction of the word “ meaning ” deserves a little more consideration. It i often said that when we meet an expression like $a + b$ or $a - b$, a mean *any* number and b means any number. This is hardly a correct way o stating the situation. In any specific case a must mean *some* number an b must mean *some* number, and the correct way of looking at the matte is this. If a represents some definite number and b represents a definit number, the same or not as a, then the expression $a + b$ has a meanin so also has $a - b$ (with perhaps a slight reservation for the moment if is greater than a) ; so also has $a\,b$. But without some extension of th meaning of the word " number " a/b might not have a meaning. That extension we now make.

Naturally we are concerned now not only with discrete, enumerable objects, but with the results of breaking them into parts and the evolution of ideas about the dimensions, weights or other physical properties of the parts, so that on some criterion parts could be called equal or unequal in magnitude. Hence obviously arise the notions of half, third, quarter, etc. These are, of course, introduced into an extended number system in the form $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, etc., or sometimes in a more convenient form for printing $1/2$, $1/3$, $1/4$. In the earliest records of arithmetical calculation among the Egyptians, the only fractions used were unit fractions, *i.e.* fractions with unity in the numerator. Thus what we would write as $2/9$ they wrote as $1/6 + 1/18$; and $2/95$ was written as $1/60 + 1/380 + 1/570$. The Greeks, Romans and Hindus used a symbolism which is equivalent to our way of writing general fractions. So we now " give a meaning " to $\frac{a}{b}$ or a/b when a and b mean " integral numbers " or " integers " such as 1, 2, 3, 4, etc., even when the number represented by a is not exactly divisible by the number represented by b; for we can picture a physical operation which breaks something into b equal parts and then selects a of them as another recognisable thing. Actually, this way of looking at the matter is only legitimate if a is less than b; the fraction is then a " proper fraction." If a is greater than b we must think of several things, only one of which is broken up into b parts. The number of whole things still left gives us a picture of an integer which is part of this " improper fraction," and the combination of the integer and the proper fraction we call a " mixed number," so that if we write the improper fraction $16/7$, it can also be represented by the mixed number $2\frac{2}{7}$. The number system now includes both integral and fractional numbers, and we can adapt our symbolism to meet the new situation by admitting that a single symbol such as a can now represent not only an integer as heretofore but also a fractional number, proper or improper, if need be. The rules for addition, subtraction, multiplication and division of fractions explained in every text-book of Arithmetic then enable us, as before, to give a meaning to $a + b$, $a - b$, $a\,b$, a/b, provided a and b represent definite numbers. The commutative and associative principles still remain in force. If we care to, we can utilise the decimal notation, in place of the usual fractional form, to indicate the fractional numbers proper or mixed numbers. There is, however, this difference, of some importance as we shall see presently, that whereas a proper fraction can always be indicated by using a finite number of ordinary figures, the corresponding decimal expression may be unending, although the figures recur. Thus:

$$\tfrac{6}{7} = \cdot 857142857142857142 \ldots$$

usually written $\cdot\dot{8}5714\dot{2}$.

We have by no means exhausted all the possibilities of number, as the Greeks recognised in their day because of their geometric genius. Since $2 \times 2 = 4$, $3 \times 3 = 9$, $4 \times 4 = 16$, $5 \times 5 = 25$, etc., it is sometimes said that the numbers 4, 9, 16, 25, etc., have square roots, while numbers like 2, 3, 5, 6, 7, 10 . . . have no square roots and so are not "perfect square" numbers. Take 2, for example; we can apply the well-known process taught in every text of Arithmetic for extracting square roots. The process works perfectly but *never ends* (except, of course, when necessity or loss of interest compels us to stop). Thus the square of 1·4 is less than 2, but the square of 1·5 is greater; the square of 1·41 is less than 2, the square of 1·42 is greater; the square of 1·1414 less, of 1·415 greater; the square of 1·4142 less, of 1·4143 greater, and so on as far as we care to go. So we can arrange a class of ascending numbers such as 1, 1·4, 1·41, 1·414, 1·4142, . . . whose squares are all less than 2 but progressively increasing towards 2 *as near as we like*, provided we take sufficient trouble. Also we can arrange a series of descending numbers such as 1·5, 1·42, 1·415, 1·4143, . . . whose squares progressively decrease towards 2 yet never quite reach it. The gap can be closed up to any degree we please, but can never be absolutely closed. The situation is tantalising, but the Greek had no difficulty in admitting that the square root of 2 really exists by adopting the following line of argument. When he reasoned about number, he nearly always pictured a number as representing some geometric magnitude such as length, area or volume. Let us draw a straight line on paper, mark a point O on it and then mark points A, B, C, D . . . so that OA = AB = BC = CD = . . . each step being one inch, say. The lengths of OA, AB, OC, OD, . . . can then be considered to represent in a geometrical sense the numbers 1, 2, 3, 4. . . . Further, by dividing the segments OA, AB, BC, . . . into equal parts as finely subdivided as we please, we can represent all the various fractional numbers, proper and improper alike. None of these points, however, will represent the square root of 2, since it cannot be expressed as a decimal *with recurring figures*, which as we know can be reduced to an ordinary fractional form with a finite number of figures in numerator and denominator. But let us construct a square OAXY on the side OA. By the Pythagorean proposition, the square on the diagonal OX is equal to the square on OA plus the square on AX, *i.e.* to the square of 1 + the square of 1, or 2. So if we mark by means of a compass point Z on the line OABC, so that OZ = OX, then just as OB can be said to "represent" the number 2, and OC the number 3, etc., in exactly the same sense OZ will represent a number whose square is 2. In short, we deliberately extend our number system to include numbers represented by any length we like marked out from O to some point on the line. In this way, by suitable constructions, the square root of any number can be given such a pictorial representation. Such considerations justify our introduction of the square



roots, cube roots, fourth roots, etc., of any number we please into our number system. We distinguish them from the integral and fractional numbers by calling them "irrational" numbers, but this epithet must not be interpreted as "unreasonable"; for the existence of these numbers is so "reasonable" an assumption that a tremendous amount of mathematics, absolutely vital for practical calculations in our scientific and engineering pursuits, would be impossible without them. So when we say that a letter a represents an irrational number, *e.g.* the seventh root of 5, we mean that a satisfies the relation

$$a^7 = 5.$$

We postulate also that if a represents such an irrational number and b another number, rational or irrational, then $a + b$, $a - b$, ab, a/b, also represent numbers and that $a + b$ is the same number as $b + a$, and ab the same number as ba. (It should be noted that if a and b are irrational numbers it cannot be concluded that ab is necessarily irrational. Thus $\sqrt{2}$ and $\sqrt{8}$ are irrational numbers; but $\sqrt{2} \times \sqrt{8}$ is not, for it is the same as $\sqrt{16}$ which is 4.) In making this postulate we are appealing to the "principle of continuity," for inasmuch as we can always find a rational number, integral or fractional, which is as near as any assigned amount, however small, to the irrational number in question, we take it that the laws which are true for rational numbers are also true for irrational.

In a former paragraph of this section we drew attention to the doubt about the validity of an expression such as $a - b$ if we knew that b represents a larger number than a does. Even so we saw that the operation indicated was not entirely unreasonable. We can now make a final extension of the number system so as to remove all trace of hesitation about accepting such an expression. Suppose you walk 6 feet in a given direction and then turn right round and walk back 4 feet, you have walked 10 feet no doubt, but the final effect is to leave you only 2 feet from where you started. If you walk 6 feet to the right and then 8 feet to the left, you are once more 2 feet from the initial mark. How can one distinguish these two cases from one another by a concise symbolism? The experience of the mathematician has guided him to a very simple answer to that question. He represents 6 feet one way by $+6$ and 4 feet the other way by -4, thus introducing what he calls "directed numbers," some of which are "positive" and some "negative." (It is entirely a matter of choice and convenience which he chooses as the "positive direction" and which the "negative direction.") He then writes an account of the first walk thus:

$$(+6) + (-4)$$

the result being $+2$. Note that in this the $+$ sign has two meanings, one to indicate the direction and one to indicate that a certain effect represented by -4 is being added to another effect represented by $+6$, the sense of the word "addition" being rather more general than before. The second walk is represented by

$$(+6) + (-8)$$

and the result is -2; for now you are 2 feet away from the start in the negative direction. The first of these can then be contracted to

$$6-4=2$$

the second to

$$6-8=-2$$

So now at one swoop we double all the numbers in our system by this convention of " directed-ness "; for to any of our previous numbers rational or irrational, integral or fractional, regarded as a positive number, there corresponds a negative number. Our letter symbols a, b, etc., now may be considered as representing negative numbers if necessity should arise. Care is needed here. Though we may not necessarily write a minus sign before a letter, say b, yet we can assume if necessary that it is representing a negative number. Thus let us consider

$$a+b$$

where a represents $+9$ and b represents -5. As indicated above, we can think of this as a walk of 9 northwards followed by a walk of 5 southwards, the result being 4 northwards, so that $a+b$ represents $+4$. The question at once rises to our lips, What about $a-b$ if b is a negative number? That can be answered by reference to a simple situation. Harry walks 9 feet north and James 5 feet north; how far is Harry away from James? Four feet to the north of him of course; *i.e.*

$$(+9)-(+5)=+4$$

But now Harry walks 9 feet to the north and James 5 feet to the south; how far is Harry now from James? The answer is of course 14 feet to the north; *i.e.*

$$(+9)-(-5)=+14$$

There we have it again: " Two negatives make a positive." We need have no hesitation about changing the sign inside the brackets if there is a minus sign outside. We could go on multiplying illustrations from all sorts of human pursuits and activities. For example, we know that there is a temperature on all thermometers marked 0, the " zero "; temperatures warmer than this are marked + (or at least that is implied if the sign is omitted), and temperatures below are marked —. How much does the temperature a differ from the temperature b? Always by $a-b$. Try it in any case. How much does $+30°$ differ from $+20°$? Answer, $(-30°)-(+20)$, *i.e* $+10°$ or ten degrees *higher*. How much does 20° differ from 30°? Answer $(+20°)-(+30)$ *i.e.* $-10°$ or ten degrees *lower*. How much does $+30°$ differ from $-20°$? Answer $(+30)-(+20)$, *i.e.* $+30+20$, or $+50$, or fifty degrees *higher*. Obviously correct, for from 20 below a mark to 30 above it is 50 steps. Again, walk up ten steps on the stairs, turn, and come down fifteen steps. Where are you? Answer $(+10)-(+15)$ steps *up*; *i.e.* (-5) steps *up*; *i.e.* really 5 steps *down*. One last illustration, so as to show what is meant by ab when a and b may represent negative numbers as well as positive. When a train travels through a station going north and we know it is travelling at a speed of 500 yards a minute, where is it 4 minutes after passing through? It is

2,000 yards away to the north. Let us now represent time which elapses after the instant when the train was at the station by positive numbers, and time which elapses from earlier moments until the instant of passage through the station by negative numbers. We symbolise the result just given by

$$(+500) \times (+4)$$

which is $+2{,}000$.

But where is the train 4 minutes later if it is going south? The answer is clearly 2,000 yards to the south; and this is brought within our symbolism if we agree that

$$(-500) \times (+4) = -2{,}000$$

so that the product of a negative number and a positive number is a negative number. Or look at it another way. When the train travelled north, where was it 4 minutes *earlier* than the instant of passage? Clearly 2,000 yards to the south, and again this is right if we agree that

$$(+500) \times (-4) = -2{,}000.$$

Lastly, and most instructive of all; where was the train, if it is travelling *south*, 4 minutes *earlier* than its moment of passage through the station? Without a doubt 2,000 yards away *to the north*. Again all right if we agree that

$$(-500) \times (-4) = +2{,}000$$

or the product of two negative numbers is a *positive* number.

It is absolutely a hopeless task to grasp the nature of mathematical reasoning, unless the reader understands the meaning of those symbolic representations which indicate the fundamental operations of arithmetic as carried out on all the variety of numbers which can be conceived by the mathematicians, and unless it is realised at the same time that these conceptions have not been spun out of an unregulated imagination, but that they have been checked at every turn by reference to many activities and occurrences in our physical world, of which only an extremely limited selection has been indicated in the preceding pages.

ALGEBRA

Having invented this concise symbolism to indicate the results of applying the four fundamental operations to the numbers of his system, the mathematician at all times has delighted in extending the range and power of his symbolic method far beyond the possibilities conceived by his ancestors.

Most people know that Algebra is extremely useful in " solving problems "; that there are, in fact, certain calculations arising in every region of practical activity, which would be entirely impossible without some symbolic way of representing numbers which are unknown at the outset but which have to be found. Every text-book of Algebra contains a selection of such problems so that the pupil, by experience of varied types, may learn to deal with them if they arise in his own pursuits. The solution of such problems involves a widening and deepening of the technical operations indicated in the previous section, and so the text-book generally devotes its earlier chapters to practice in the handling of " formulæ." The reading and understanding of a formula is an absolute necessity for an engineer, chemist, physicist or architect, to single out a few professions. For example, to take the first one that comes to hand from an engineer's table-book, C^2Rt. This has a meaning if C and R and t have meanings. Actually it tells you that you multiply the number indicated by C by itself, then multiply that product by the number which R represents, and that product by the number presented by t. As used by the engineer, C is the number of ampères in a current, R is the number of ohms in the resistance of a wire, and t is the number of seconds for which the current has been running, and the calculated value of the formula indicates to him the amount of heat which has been developed in the wire. In these days of electric heaters there is no need to stress the " usefulness " of the information which C^2Rt compresses into itself so compactly.

Take another one, this time an " expression " from a book on Algebra, $x^2 - 5xy - 7y^2$. This expression has three " terms." The first term, x^2, tells you to square the number indicated by x ; the second term tells you to multiply the number indicated by x by the number indicated by y and that product by 5 ; the third term tells you to square the number indicated by y and take 7 times that result. You then subtract the second term from the first, and from the difference you again subtract the third term. An operation which requires six lines of print to explain in ordinary words is indicated by the printed letters in one third of a line.

Then there are operations of great service which are indicated by a symbolism such as this :

$$a\,(b + c),\ a\,(b - c),\ (a + b)\,(c + d),\ \text{etc.}$$

Take $a\,(b + c)$ for instance. It indicates, by this use of the brackets, that b and c are to be added and that a is then multiplied by the sum. Try this on $5\,(7 + 3)$. The result is 5×10, or 50 ; but notice that 5×7 is 35 and 5×3 is 15 and these add to 50. That is

$$5\,(7 + 3) = 5 \times 7 + 5 \times 3.$$

This suggests that

$$a\,(b + c) = ab + ac$$

and trial with any numbers always justifies this general statement.

Similarly, trial with any numbers always justifies

$$a\,(b - c) = ab - ac$$

and we can extend this indefinitely thus

$$a\,(b + c + d - e \ldots) = ab + ac + ad - ae \ldots$$

This is called " distributing " a among the terms inside the bracket and the result is called the " Distributive Law."

Take a still wider form

$$(a + b)\,(c + d)$$

As a matter of trial, insert 10 for a, 8 for b, 4 for c, 3 for d. The result is:

$$18 \times 7 \text{ or } 126.$$

Now notice that ac is 40, ad is 30, bc is 32 and bd is 24. Add these four numbers and the result is 126. So this suggests that

$$(a + b)\ (c + d) = ac + bc + ad + bd$$

and trial with any numbers will always justify it. But actually, if we are satisfied that our previous result is correct, we need no numerical trials to convince us that this is also correct; for we have only to apply the Distributive Law twice to "prove" it. Thus

$$(a + b)\ (c + d) = (a + b)\ c + (a + b)\ d$$

where we regard $(a + b)$ for the moment as one numerical entity. Now apply the law again to the right side

$$(a + b)\ c + (a + b)\ d = ac + bc + ad + bd$$

and the proof is completed.

Again take $(a + b)\ (c - d)$; it is equal to $(a + b)\ c - (a + b)\ d$, and this is equal to $ac + bc - (ad + bd)$ and this to $ac + bc - ad - bd$ *if the rule about changing signs inside the bracket is all right here*. Try it on any numbers and it is so. Thus with the numbers used above $a + b$ is 18 and $c - d$ is 1, so the result is 18; 18 is also equal to $40 + 32 - 30 - 24$. Finally consider

$$(a - b)\ (c - d).$$

This is $(a - b)\ c - (a - b)\ d$, and that is $ac - bc - (ad - bd)$, or $ac - bc - ad + bd$, and numerical trial again justifies the general rule for changing the sign on removing the bracket after a minus sign.

Now all these separate results can be summarised in one result, provided we remember that the letters may represent *negative* numbers, if need be, as well as positive. Thus

$$(a + b)\ (c + d) = ac + ad + bc + bd$$

is a truth, even if some of the letters represent negative numbers. Put $+9$ for a, -5 for b, $+4$ for c, -2 for d.

The left side is

$$[(+9) + (-5)]\ [(+4) + (-2)]$$
$$\textit{i.e.}\ (+4) \times (+2) \text{ or } +8.$$

The right side is

$$(+9) \times (+4) + (+9) \times (-2) + (-5) \times (+4) + (-5)\ (-2).$$

Now comes a clinching test concerning the products of positive and negative numbers. If what we have pointed out in the previous chapter is generally true, then

$$(+9) \times (+4) = +36$$
$$(+9) \times (-2) = -18$$
$$(-5) \times (+4) = -20$$
$$(-5) \times (-2) = +10.$$

Add the four numbers ; *i.e.* add " in the algebraic sense," *taking account of the signs* ; the result is as follows : $(+36) + (-18)$ is $+18$, $(+18) + (-20)$ is -2, and $(-2) + (+10)$ is $+8$, and $+8$ is what we got above.

Special cases of these results are extremely useful at times. Here are two which are always turning up :

$$(a+b)^2 = a^2 + 2ab + b^2$$
$$(a-b)^2 = a^2 - 2ab + b^2$$

or, in words, " the square of the sum of two numbers is equal to the sum of their squares together with twice their product, and the square of their difference is equal to the sum of their squares less twice their product." But how compact the symbolic statement is as compared with the verbal.

Here is another valuable little " friend in time of need " :

$$(a+b)(a-b) = a^2 - b^2.$$

Another piece of skill which the mathematician must cultivate, as a craftsman must cultivate skill with his tools, concerns the same kind of operations as those just mentioned looked at from the opposite point of view. We can easily see that

$$\begin{aligned} &(3a+4b)(2a+7b) \\ &= 6a^2 + 8ab + 21ab + 28b^2 \\ &= 6a^2 + 29ab + 8b^2. \end{aligned}$$

But suppose I write down

$$5a^2 + 41ab + 8b^2.$$

Can I do the reverse operation on this and represent it as the product of two " factors " ? Actually I can " factorise " the expression ; it is equal to $(5a+b)(a+8b)$. But, as a matter of fact, it is not always possible to do this for any expression like the above with any random numbers written down in place of the 5, the 41, and the 8 ; at least, not with the numbers which we have considered so far, *i.e.* the " real " numbers, integral or fractional, rational or irrational, positive or negative. Even when the factorisation is possible the numbers in the factors do not generally come out so nicely and may involve cumbersome fractions, or even irrational numbers. For example, $a^2 + b^2$ has no factors like the above ; $a^2 + 6ab + 7b^2$ has, but they are

$$[a + (3 - \sqrt{2})b][a + (3 + \sqrt{2})b].$$

Cultivation of skill in factorisation, combined with the recognition of the occasions when it is possible and when not, is one of the most useful accomplishments which a mathematician can cultivate, and a good number of pages in every book on Algebra is devoted to teaching all the methods and artifices which experience has revealed as necessary for the purpose and for the multifarious types of expressions which may occur.

Of course the examples of an algebraic expression which have been written above are relatively simple ones. An expression might consist of many more terms and each term might be much more complex in structure. In addition we could build still more complicated expressions consisting of products, quotients and powers of those just indicated.

Here is one which has a special significance for any reader who is interested in wireless matters and may have heard of the " impedance " of an electric circuit, a word bandied about freely in conversation between wireless enthusiasts :

$$\sqrt{\left\{\left(2\pi Lf - \frac{1}{2\pi kf}\right)^2 + R^2\right\}}$$

As an algebraic expression it tells you to carry out a group of calculations. First you multiply the number f (which is to be read as an abbreviation for " the number represented by f ") by the number L and the result you multiply by the number π and double. From that you subtract the number obtained by dividing the product of the numbers f, k, π and 2 into unity. This result is squared and then added to the square of the number R, and you then extract the square root. An engineer's pocket-book in which you will find this formula will tell you that this is the impedance of an electric circuit whose " resistance," " inductance " and " capacity " are equal to the numbers R, L and k respectively in the usual electric units and in which there is an alternating current of frequency f. The number π is the ratio of the circumference of a circle to its radius. You would also find in the same pocket-book, in the same connection, another expression such as this :—

$$\frac{E}{\sqrt{\left\{\left(2\pi Lf - \frac{1}{2\pi kf}\right)^2 + R^2\right.}}$$

which suggests that you should divide the number calculated above into the number E, the object of this division being to obtain the so-called " peak " value of the alternating current excited in this circuit when an alternating electromotive force, whose " peak " value in E, is applied to it.

Now let the reader be under no misapprehension that this symbolic writing is only of value as a kind of convenient shorthand, indicating concisely certain necessary and useful practical calculations. That would be a painfully inadequate view of the situation. After all, these expressions were not originally written down at the dictation of some eminent mathematician. They were *proved*. They were deduced by plain, ordinary reason from certain principles and, what is more, the deduction *would have been a sheer impossibility without the symbolism*. It will be illuminating if we just refer to those principles for a moment. First of all there come the " physical principles," *i.e.* the laws discovered by experiment and trial, in this case the laws of electric circuits first propounded by men like Ohm, Faraday and Maxwell. These enable one to write down an " equation," which is just a statement of an equality between the values of two mathematical expressions. The experimenter, the physicist, has now had his say and the mathematician takes up this equation, absolutely unconcerned as to what the symbols in the equation " mean." To him they are purely abstract quantities to be treated according to the principles of his science, among which we first of all meet " logical principles," which are those universal rules admitted on all hands to be vital to any kind of reasoning. Such, for instance, are the statements that " two things which are equal to a third, are equal to each other," or " remove equals from equals and the remainders are equal," etc. . . . But there are, in addition, principles bearing on the handling of his special symbolism, mathematical principles proper, *e.g.* the laws of commutation, association, distribution referred to above, and others which we cannot here mention or illustrate. This may help the reader to understand that algebraic symbolism is not merely a convenient " language," but is an indispensable part of the machinery of certain kinds of reasoning, and that the mathematician proper, the " pure " mathematician as he is conveniently named, is more interested in his processes of deduction and the development of the range and power of his symbolism than in the useful, practical formulæ which he, and he alone, can obtain.

The reference just made to an " equation " may remind the reader that when we begin to work out a problem we always expect to " turn the problem into an equation " ; so that equations are vitally connected with problems. Yet it is more instructive (or so the writer thinks) to show how the mathematician would come to be interested in equations, quite apart from their practical value in discovering the answers to problems.

Let us consider the letter x as representing some number, and let us write down a few algebraic expressions in which it is involved :—

$$\begin{gathered} 4x - 8 \\ 3x + 4 \\ x^2 + 2x - 68 \\ x^3 + 7x^2 + 5x + 9 \\ x^4 - 10x^3 + 8x^2 - 7x + 1. \end{gathered}$$

The first two expressions only involve x itself and not a square, or third power, or fourth power, etc. . . . of x. They are called " linear " expressions ; the third one is called a " quadratic " expression, because it involves the second power or square of x (*x quadratus*) as well as the first power ; the third is called a " cubic " expression because it involves the cube of x ; the fourth a " quartic," and so on. It is obviously a simple matter to insert a special number for x, and calculate the numerical value of any of these expressions which corresponds to the special value of x. As we " vary " the value of x, the value of any such expression also varies ; for clearly the latter depends on the former. In technical language we often refer to x as an " independent variable " and then call any expression which involves it, and which is therefore dependent on it as regards numerical value, a " function of x." But what interests the mathematician is the inverse operation to what has just been indicated. He asks, " If I give a numerical value to the expression or function, can I find what is the value of x which will fit this ; or indeed is there a value which will do it " ? Let us try the mathematician's puzzle with some of the expressions above. Take the first one and ask what is the value of x which will make it have the value 12. This gives us the " equation "

$$4x - 8 = 12.$$

Now we apply the *logical* principle, " add equals to equals and the sums are equal." Let us add 8 to each side

$$4x - 8 + 8 = 12 + 8$$

or
$$4x = 20$$

and so
$$x = 5.$$

We see at once why we add 8 to each side ; it gets all the terms indicated by actual numerals together ; it amounts to transposing — 8 to the right side and changing the sign. It was this *uniting* process to which the Arabs referred when they used the word " al jabr " and this, it will be recalled, gave the name of the subject by reason of the title of an Arabic book.

Let us try to answer the same question for the third expression ; let us ask if there is a value for x which will make $x^2 + 2x - 68$ equal to 12. The reader will find that if he puts x equal to 8, the quadratic expression is equal to 12 ; for x^2 is then 64, $2x$ is 16 ; so their sum is 80 and thus if 68 is taken away, 12 remains. Yet obviously it would take more " guessing " than in the previous instance to arrive at this value of x. Is there no routine way of getting at the required result ? Well, there is, and there is also a modification of it which yields the result very quickly in certain cases, provided one is expert at the process of factorisation mentioned earlier. The present example happens to be one in which the modified method works. Let us write down our equation :—

$$x^2 + 2x - 68 = 12.$$

Let us apply the logical principle that if we remove equals from equals, then equals remain and take away 12 from each side

$$x^2 + 2x - 68 - 12 = 12 - 12$$

or
$$x^2 + 2x - 80 = 0.$$

This is the " transposition " process working a little differently than in the previous example with the linear function. Now anyone with experience in factorisation will split the left hand expression above into two factors ; they are $x - 8$ and $x + 10$, and the reader at all events can satisfy himself that this is so ; for by repeating the process already referred to in stating the principle of distribution he will find that

$$\begin{aligned}(x - 8)(x + 10) &= x(x + 10) - 8(x + 10)\\ &= (x^2 + 10x) - (8x + 80)\\ &= x^2 + 10x - 8x - 80\\ &= x^2 + 2x - 80.\end{aligned}$$

So we again modify the equation into

$$(x - 8)(x + 10) = 0.$$

The answer, x is equal to 8, is now justified, for if we make x equal to 8, one of the factors becomes zero and the other 18, and 18 times nothing is just nothing. But we have discovered something more ; for if we put -10 for x (note the minus sign most carefully), then one of the factors is o and the other is — 18 and the product of o and — 18 is o. So if we substitute — 10 for x in $x^2 + 2x - 68$ we should get 12, and this is so, for $(-10)^2$ is + 100 (remember that "the product of two negative numbers is positive" is a rule satisfied by our symbolism); also $2x$ is — 20 and $+ 100 - 20 - 68 = + 80 - 68 = 12$. Of course the choice of 12 as the number to which the quadratic expression is to be equal made this method "work simply." Had we chosen another number, the factorisation would not have been so easy; for instance, suppose we had asked for the expression to be equal to 10 instead of 12, it would be a little more awkward but not impossible. The equation would be now

$$x^2 + 2x - 68 = 10$$

and on transposing as before we would have

$$x^2 + 2x - 78 = 0$$

and the reader can try as hard as he like, but he will not find any two simple integers whose difference is 2 and whose product is 78 (for that is what the previous solution amounted to). Still we are not beaten; the mathematicians of the middle ages taught us how to get round this trouble. We apply the transposition process differently, more like the way we applied it in the first problem. Add 68 to each side and we find

$$x^2 + 2x - 68 + 68 = 10 + 68$$

or

$$x^2 + 2x = 78.$$

Now add 1 to each side. Why? Because by so doing we obtain on the left-hand side an expression which is a "perfect square." Thus

$$x^2 + 2x + 1 = 79$$

But

$$x^2 + 2x + 1 = (x + 1)(x + 1) = (x + 1)^2.$$

Hence

$$(x + 1)^2 = 79$$

and

$$x + 1 = \sqrt{79}$$

so that

$$x = \sqrt{79} - 1.$$

So we have found the answer, although the number to be substituted for x in order to make $x^2 + 2x - 68$ equal to 10 is not a simple integer, but an irrational number. But let us pause; when we asked for the expression to be equal to 12, we found there were *two* answers possible. Why are there not *two* now? Well, there are, for there are *two* irrational numbers whose square is 79, *viz.* $+\sqrt{79}$ and $-\sqrt{79}$, and so when we found that

$$(x + 1)^2 = 79$$

we could write

$$x + 1 = -\sqrt{79}$$

as a possibility just as much as

$$x + 1 = +\sqrt{79}.$$

Obviously x cannot be chosen to satisfy both these demands at once, but if we make x equal to $-\sqrt{79} - 1$, it will make $x^2 + 2x - 68$ equal to 12, just as much as putting $+\sqrt{79} - 1$ for x.

This second method, technically called "completing the square," is always applicable in the case of any quadratic expression. Let us give another example. Suppose we want to make $x^2 + 6x + 12$ equal to 6, what value of x will do? Write down the equation

$$x^2 + 6x + 12 = 6.$$

Subtract 12 from each side

$$x^2 + 6x = 6 - 12 = -6.$$

Now add 9 to each side

$$x^2 + 6x + 9 = -6 + 9 = 3.$$

The addition of 9 was made as before so as to produce a perfect square on the left side; for $x^2 + 6x + 9 = (x + 3)(x + 3)$ or $(x + 3)^2$.

Thus $$(x + 3)^2 = 3$$

and so either $$x + 3 = +\sqrt{3}$$

or $$x + 3 = -\sqrt{3}$$

and therefore $$x = +\sqrt{3} - 3$$

or $$x = -\sqrt{3} - 3.$$

Two irrational answers arise as before, but still *two* answers, and that is a general feature of all "quadratic equations."

In order to bring out a feature of the relation of these equations to problems about actual things and not about abstract numbers, let us consider the following "puzzle" as we might call it. "A number of posts is set up in a space of 40 yards at equal distances. Had there been 2 posts more, the gap between two adjacent ones would have been reduced by 1 yard. How many posts are there?" Suppose the number of such gaps is x at first, so that there are in fact $x + 1$ posts. Then the distance between neighbours is $40/x$ yards. We are told that if there are $x + 3$ posts and therefore $x + 2$ gaps, the distance between neighbours is $40/x - 1$ yards. If that is so, the whole length must be

$$(x + 2)\left(\frac{40}{x} - 1\right) \text{ yards.}$$

But this is 40 yards. Therefore we have our equation

$$(x + 2)\left(\frac{40}{x} - 1\right) = 40.$$

Use the distributive principle to work out the left side. Thus

$$(x + 2)\left(\frac{40}{x} - 1\right) = x \times \frac{40}{x} - x + 2 \times \frac{40}{x} - 2$$

$$= 40 - x + \frac{80}{x} - 2$$

$$= 38 - x + \frac{80}{x}$$

Hence $$38 - x + \frac{80}{x} = 40.$$

Logic gives us $$-x + \frac{80}{x} = 2.$$

But that multiplying equals by equals gives equals is likewise logical; so multiply each side by x. The left side becomes $x\left(-x + \frac{80}{x}\right)$ and the right side, $2x$.
Distribute the left side once more and we obtain $-x^2 + 80$ from it, and so

$$-x^2 + 80 = 2x.$$

Add x to each side and by logic

$$80 = 2x + x^2.$$

But this is just the equation we worked out a moment ago. It has two "roots" (as they are called), namely, $+8$ and -10; *i.e.* either of these values, if substituted for x, will satisfy the equation. But clearly the second one is no good to us *for our problem*; we cannot have minus 10 gaps and minus 9 posts; however, the first root is all right, 8 gaps, *i.e.* 6 posts, will work, as the reader can easily show.

Now this is really an important point. When we are dealing with a problem about the counting of real things, our answer must be in those numbers *with which we can count*, *i.e.* the *positive* integers. So when we reduce our problem to an equation, if no root of the equation is such a number we have shown that the problem is impossible *about real things*; but the equation is still possible for the abstract numbers of the mathematician, which include negative and irrational numbers, and, paradoxical as it may seem, an enormous amount of his work, not only of intense interest to himself but of great practical service to scientists, engineers and others, would be impossible without such equations. Nay, more, we can, to conclude this chapter, give the reader an example of a still more apparently ridiculous kind of number. Suppose we asked for a value of x which would make the expression $x^2 + 10x + 30$ equal to 4. The equation is

$$x^2 + 10x + 30 = 4$$

leading to $$x^2 + 10x = 4 - 30.$$

We complete the square by adding 25 (which is the square of 5, 5 being the half of 10). Thus

$$x^2 + 10x + 25 = -26 + 25 = -1$$

or $$(x + 5)^2 = -1.$$

So $x + 5$ must be equal to the square root of *minus one*! "Now this *is* arrant rubbish," the reader possibly exclaims, "if you ask me to believe that any numbers when squared give a minus result. That a positive number when multiplied by itself gives a positive result I have always known, and you have been most careful to insist that if I multiply a negative number by itself, that is also positive." Quite so; that is perfectly true about the numbers *we have so far defined*, integers, fractions, irrationals, positive or negative. There is no use throwing up the reproach that the square root of minus one is a number we "can't count with." Irrationals are of no use for that. Actually the mathematician "invents" (for that is really what he does) a whole host of new numbers, which he *defines* to be such that their squares are -1, -2, -3, -4, or indeed minus any of the positive numbers, rational or irrational, previously defined. His former numbers he groups under one title —"real." These new numbers he calls "imaginary." Once more his own curiosity and ingenuity enable him to work out a host of interesting properties which they possess, and although of course they are of no use for "counting" (being in no worse plight than the irrationals in that connection) it is a fact, perhaps astonishing to the reader but none the less true, that many practical conclusions deduced by him for the scientist and engineer would be much more difficult to work out without these "imaginaries." For instance every electrical engineer, studying the derivation of the formulæ used in connection with alternating current machinery, must be familiar with these peculiar but exceedingly useful numbers.

In short, numbers are abstract entities only limited by the definitions we impose on them. After all, "definition" is only another word for limiting.

It should be mentioned that when we equate a cubic or quartic expression to any number we obtain cubic and quartic equations. These are always soluble provided we admit irrational and imaginary answers as valid whenever they turn up. There are always three roots for a cubic equation, and four roots for a quartic. Similar statements are true for equations of still higher "degree," but they involve methods of solution which are extremely complicated and only few mathematicians of the very "advanced" order pursue the "Theory of Equations," as this branch of Algebra is called, to such ultimate stages.

The reader may have heard of "logarithms" and "slide rules" as practical means for carrying out otherwise tedious calculations with ease and expedition. He may therefore be interested to read a word or two about the "nonsensical" notion (for so he will think at the first glance) upon which these are founded. We know what 2^2, 2^3, 5^2, 5^4, . . . mean ; the last one is, as he would say, "Four fives multiplied together." "What then is $5^{\frac{1}{2}}$?" Five multiplied by itself a half times ! ! Consider these few results

$$\begin{aligned} 5^2 \times 5^3 &= 5^5 \\ 5^4 \times 5^3 &= 5^7 \\ 5^6 \times 5^4 &= 5^{10} \end{aligned}$$

and so on.

Note that the index on the right is always the *sum* of those on the left ; for when you multiply, for example, 5^4 by 5^3, the number of fives involved is 7. Well then it is obviously true that

$$\begin{aligned} 5^1 \times 5^1 &= 5^2 \\ 5^2 \times 5^2 &= 5^4 \\ 5^3 \times 5^3 &= 5^6. \end{aligned}$$

Suppose we *agree* that $5^{\frac{1}{2}}$ shall obey the same rule ; then

$$5^{\frac{1}{2}} \times 5^{\frac{1}{2}} = 5^1$$

for the sum of $\frac{1}{2}$ and $\frac{1}{2}$ is 1. So $5^{\frac{1}{2}}$, *by our agreement that the law of indices is to be general,* turns out to be $\sqrt{5}$, the square root of 5. Similarly $5^{\frac{1}{3}}$ is the cube root of 5, $5^{\frac{1}{4}}$ the fourth root and so on. We can go further and give a meaning to a negative index. It turns out that 5^{-2} is the result of dividing 5^2 into unity; it is $1/5^2$, 5^{-3} is $1/5^3$, and so on.

Here then is a further example of the mathematician widening his powers by generalising his definitions; and as already stated, quite apart from his own pleasure and interest in the new extensions of his methods, every table of logarithms and every slide rule used by practical calculators depend on this new extension.

In this way Algebra, which came on the scene as generalised Arithmetic, gradually took on a character of its own. As in Arithmetic the notion of number was separated from any association with any particular set of objects, so in Algebra the notion of number was even further refined so as to be abstracted from reference to any particular numbers. Just as a number like 7 refers impartially to any group of seven objects, so in Algebra a letter like *a* or *x* is used to refer impartially to any number, on the understanding of course that each letter in any particular problem, or in any particular analysis of a particular expression, must refer to the same number throughout. Analysis of expressions, such as those suggested above, and many other types, some of incredible complexity, gradually led to the notion of " variable " and " functionality," and the reader will realise that the idea of functionality is the mathematical counterpart of the well-established order of nature expressed in the experimentally discovered laws of the physicist and chemist. Just as the value of an algebraic expression depends on the values of the variable or variables which appear on it, so does a physical quantity (like a gravitational force, for instance) depend on other physical magnitudes with which it is related by observation (distance apart and masses of the gravitating bodies, for instance). Without such mathematical expressions and the technical means of manipulating them invented by the mathematician *for their own sake*, mathematically expressed laws of nature, which came on the scene in the seventeenth century and have since multiplied in number and importance, would have been a sheer impossibility.

GEOMETRY

Our external world is a world of form, colour and sound. The forms of visible objects are infinite in their variety, and frequently the form of even one body will change under the action of wind or other natural causes in a most varied manner. The study of the fundamental laws of shape has always been an absorbing pursuit for the mathematician. The Greek philosophers were attracted to this study, in which they showed pre-eminent genius, when they became acquainted with the rules of mensuration and land-surveying discovered by the Egyptians. Although they gave the name " Geometry " to this study, thus acknowledging the source from which the impulse came, they regarded mere " earth-measuring," as compared with the true science of Geometry, in much the same light as they regarded mere calculation in comparison with Arithmetic or a true science of numbers. Mensuration was an art useful no doubt in practical life, but no substitute for the study of Geometry in the eyes of the cultivated man.

When we look at any ordinary object such as a stone we see that it has a surface. The stone itself is " extended in space." We say it is extended, or has extension, in three dimensions, meaning that every body can be considered as divided into parts, the majority of which, apart possibly from parts near its surface, can be conceived to be of the rectangular block shape, and about such a block *three* statements have to be made before its size and shape are given, *viz.*, statements about the magnitude of its length, breadth and height. But the surface is not extended in quite the same way. If we put the point of a pin in contact with the stone, we say that the point is " on the surface of the stone " ; but a little thought will show that it is just as correct to say that the point is on the surface of the air which lies around the stone ; in short the surface belongs to the air as much as to the stone ; it separates the air from the stone ; it really " contains " neither stone nor air. Look at this in another way. Move a pencil downward from air into water ; we can be quite sure when the " point of the pencil," meaning the little tip of graphite at its end, is entirely in the air, and when entirely in the water. We recognise, however, that there is a short interval during which it is partly in air, partly in water. We may say in colloquial language that it is then on the surface of the water ; but this is absolutely incorrect in strict geometrical language. A body extended in three dimensions, however small, *cannot be contained in a surface*. It is clear that in introducing the notion of surface we have embarked on another adventure of abstraction, of a different type from that employed when we begin to deal with number. The surface is extended only in two dimensions. A common error is to regard a sheet of paper as a surface ; a sheet of paper is a rectangular *solid* just like a block of wood. I measure the thickness of a book apart from its binding and I find it to be one inch ; there are 300 pages in the book ; so each page has a thickness of 1/300 inch, and there are specimens of paper thinner than this. But any fraction of an inch, however small, is not *nothing* in magnitude. So a sheet of paper has six faces just like any other rectangular solid, although four of its faces are rectangles in which a pair of sides have a very tiny length.

Let us take another glance at a block of wood ; its surface (or to be quite accurate the surface between the wood and the surrounding air—but we will not be pedantic in future so as to avoid long phrases) has six parts ; we call them " faces." These faces cut each other at the edges of the blocks ; each edge is common to two faces and, by reason of this property, is extended one dimension less than a surface ; it is extended only in one dimension, or, as the text-book has it, it has length, without breadth or thickness. Notice that this is not true of a thread or wire, however thin. All actual bodies are extended in the full three dimensions. It is not even true of the graphite strokes which we make on paper with a lead pencil and call " lines." A line in the strict geometrical sense is the result of a double abstraction carried out on actual matter ; while the stroke on paper has obviously a breadth (or it would not be seen) and has a depth also, being in fact a very shallow ridge of graphite lying on the page. Even the printed letters on this page have some depth. Actually, edges of blocks are frequently blunt or rounded enough to be obviously lacking in the strict characteristics of a true geometrical line, and even the sharpest edge has just sufficient bluntness to show that a line is really an abstraction from the external characters of real bodies.

There is still another abstraction to be made and we reach the idea of " point." Edges of blocks meet in corners ; a corner is common to two edges ; and so, although in actual fact it is not strictly a point in the genuine sense by reason of some amount of bluntness however sharp it may feel, the corner gives us the idea of two strict geometric lines crossing and having as a common element a point, an entity which may be said to be in a definite place but is not extended in any dimension at all ; " it has position but no parts " ; or it has position but neither length, breadth nor thickness ; or, briefly, it has position but no size.

Now points, lines and surfaces are the abstractions with which Geometry is concerned ; with these and certain axioms and definitions about them it proceeds to build up a wonderful science of form, unfolding gradually by processes of pure thought an amazingly complicated structure of propositions or " theorems," to whose number there appears to be no limit save that set by pure exhaustion of human interest.

The great Greek mathematician Euclid, who lived about the beginning of the third century B.C., made a famous collection of geometrical theorems and problems known in his time ; he arranged them in a logical order so that each proposition could be deduced from previous propositions. This work in thirteen books, copied many times (and in later ages printed for many publishers), edited and commented on by many great scholars, has remained until quite recent years the only text-book for pupils desiring to understand Geometry. So universal was this practice that " Euclid's *Elements* " (often abbreviated simply to " Euclid ") was a recognised synonym for " Geometry." Many of the editors added additional propositions and submitted to the reader lists of further theorems on which to try his skill (such theorems are often called " riders "), but with few exceptions the arrangement and methods of proof adopted by Euclid were unaltered, apart from the introduction here and there of certain simpler ways of phrasing sentences.

Euclid begins by making certain statements which he calls *definitions*, *postulates* and *common notions*. The definitions refer to the abstract material mentioned above, namely points, lines and planes ; to figures such as squares, rectangles, triangles, etc., which can be constructed with lines ; to other figures such as circles, and in the later books to solid figures such as cubes, pyramids, spheres, etc. The postulates refer to certain operations which he assumes to be allowable, or to certain geometrical statements which he cannot prove but considers to be evident without proof. *E.g.*, he postulates that a *straight line* can be drawn from any one point to any other ; he also postulates that although an infinity of different lines can join two given points, *only one of these is straight* or, what comes to the same thing, two straight lines cannot enclose an area. The reader's attention is drawn to this. Everyone has intuitive, practical notions of straightness ; tight threads, edges of rulers, sighting along marks, etc., are illustrations of these practical notions ; but a straight line cannot be defined in a strict theoretical sense. Any such definition is simply a verbal phrase involving words and ideas as undefinable as straightness itself. It is in these postulates of Euclid that we find those properties of straight lines which are necessary and sufficient for the proofs of subsequent propositions. Another postulate requires us to admit that a circle may be described with its centre at any given point, and its circumference at a given distance from that point. This implies the use of compasses, but it should be carefully noted that although in one of the earlier postulates Euclid assumes that we can join two points by a straight line, thus implying the use of a ruler, he *does not assume that the ruler is graduated by marks into equal divisions*. The reader may have heard the statement that although we can bisect any angle " by Euclid," we cannot trisect it, and may have thought that there was some mystery surrounding the denial of an operation which is so palpably possible, say with a protractor. But he is reminded that the impossibility is dependent on the conditions postulated by Euclid. With a graduated ruler the process is possible, in fact not at all difficult; but it cannot be achieved if we limit ourselves to the only instruments whose use is postulated by Euclid, that is to say, a pair of compasses and an *ungraduated* ruler.

There is another famous postulate about parallel straight lines, but we shall leave that for a moment and consider some of the statements which Euclid calls " common notions." In using this phrase Euclid was following the lead of Aristotle, who suggested the use of this term instead of " axiom." The word " axiom " (a statement worthy of belief), however, has persisted and is in common use in all the editions of Euclid now extant. To be sure, Aristotle was very precise in the meaning he attached to " axiom " ; according to him, it should only be used for statements of a general nature, not geometrical, which we assume to be true; when geometrical statements are made the correct name for them should be postulate, or definition, or common notion. Thus of the following two axioms or common notions of Euclid, only the latter would be a true axiom according to Aristotle. " Things which coincide when applied to one another are equal to one another." " The whole is greater than the part." The former statement he would have classed as a definition of geometric equality, or perhaps postulate. Here are some axioms :—" If two or more magnitudes are equal to the same magnitude they are equal to each other " and " If equal magnitudes are added to other equal magnitudes the sums are equal." There has been, however, in the past a certain amount of variation in the use of the words " postulate " and " axiom " ; thus the parallel postulate, to which we referred above and which will be discussed presently, is more frequently referred to as the axiom of parallelism.

The propositions of Book I. of the *Elements* fall into three groups. The first group deals with triangles, and intersecting straight lines and the angles between them ; in these the concept of parallelism is not required. The second group introduces the idea of parallelism by means of the famous postulate referred to above. There is a good deal of misconception about this idea, and so we shall consider Euclid's treatment of it and some modern modifications, since they have a very important bearing on our ideas about the nature of the physical space in which we observe all our phenomena of position and motion. Among the first group of propositions in Book I. there is one in which he proves that any two angles of a triangle make up less than two right angles. So if two straight lines in a given plane cross a third straight line at B and C and themselves intersect at A the angles marked I and II in the figure, when added together, are less than two right angles (Fig. 2).

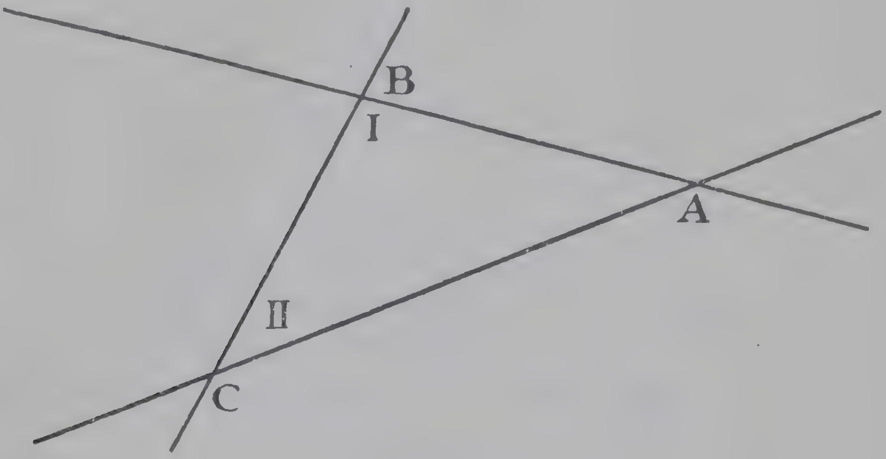


FIG. 2

Now suppose that the two lines cross the third line at B and C and make the two angles marked I and II together equal to two right angles (Fig. 3), then the lines do not meet, at all events on the right hand side. This can be

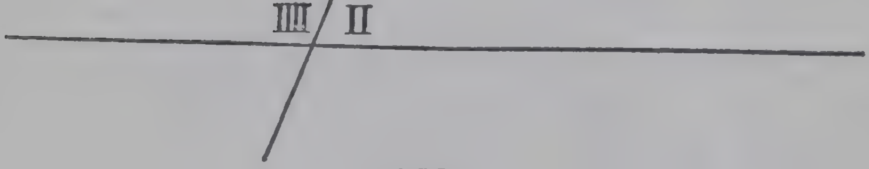


FIG. 3

proved by the so-called method of *reductio ad absurdum* (reduction to an absurd conclusion). For if the lines are assumed to meet on this side then by the earlier proposition I and II are together less than two right angles, which is a conclusion contradicting the hypothesis that they make up two right angles. Moreover, since it can be shown from earlier propositions that if I and II together make up two right angles, then the angles marked III and IV do likewise, it follows that the lines do not meet on the left-hand side.

Now comes the critical point. Consider a line marked XY in the figure and a point marked B (Fig. 4). We see that there is at all events *one* line

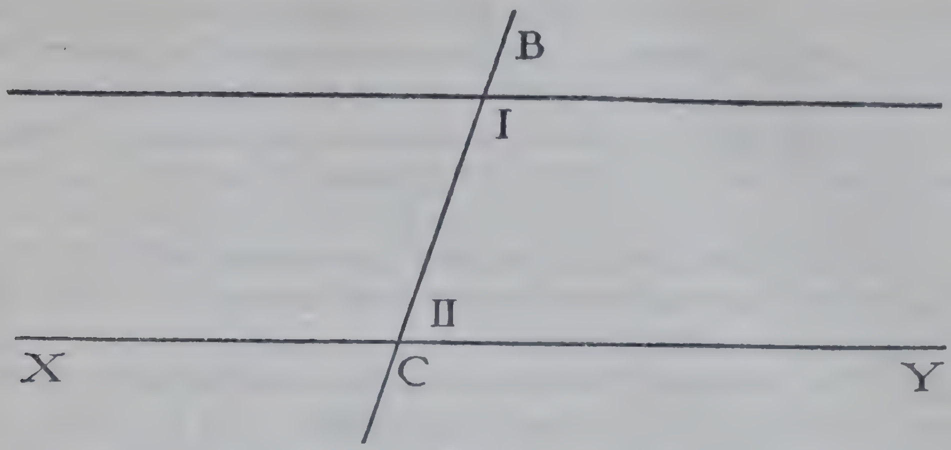


FIG. 4

through B (in the plane of B and XY of course) which does not meet XY anywhere, no matter how far extended in either direction. It is a line so drawn as to make the angles marked I and II together equal to two right angles, where BC is any line drawn to cut XY. The question is, Are there any other lines in the plane through B than this one which enjoy the same property ; *i.e.*, is there *only one* line through B in the plane which does not cut XY anywhere ? Now the reader must put all *intuitive* notions, based on hedgerows running side by side along very straight roads, or on railway lines or like objects, sternly out of his mind. The argument is not about *material objects* at all, but about creations of the mind abstracted from such material objects. In the nature of things, obviously, no one can prolong such objects to any length he likes ; such prolongation as can be effected is not even " in a plane," but on the curved surface of the earth.

Now on this question, Euclid postulated that there is only one parallel line through B, *i.e.*, only one line which does not intersect XY anywhere.

He phrased his postulate thus :—" If a straight line meeting two other straight lines makes the two interior angles on one side of it together less than two right angles, the two lines are *not* parallel ; but can be made by production to meet on the side on which are the two angles less than two right angles." This clearly denies the property of parallelism to any line through B, except the one which makes the sum of the two interior angles (the angles marked I and II in Fig. 4) equal to two right angles ; but the reader must carefully note that Euclid had to *postulate* it ; he could not *prove* it from his earlier axioms, postulates and theorems. Since his own time mathematicians in all ages have felt that the situation was not satisfactory and have made ingenious attempts to prove this famous postulate, but to no avail ; it has always appeared on rigorous investigation that the supposed proof concealed an assumption which was tantamount to Euclid's own postulate. An interesting feature of the situation is the fact, already stated, that at an earlier stage in his first book Euclid proves quite satisfactorily (and of course before he refers to parallel lines at all) that two angles of any triangle are together less than two right angles, from which it follows as an obvious result that if two lines are drawn to cut XY and if they meet, then the two interior angles on that side are together less than two right angles. Thus Euclid's postulate is the " converse " proposition to this earlier theorem ; *i.e.*, a proposition in which what is stated as the conclusion in the other proposition is now stated as the hypothesis, and what is stated as hypothesis in the other proposition is now stated as the conclusion. The unsophisticated reader may naturally think that it should be all right and that if we can prove a proposition to be true, we have *ipso facto* proved the converse proposition to be true. But that is not so. After all, geometrical reasoning uses the propositions of Logic, as well as the special postulates and proved propositions of Geometry itself, and the Logicians can easily confute the facile assumption that a proposition and its converse must *of necessity* both be true. It may be so, but not *of necessity*. The converse proposition must be as rigorously investigated as the one to which it is converse. For example, " If an object is red, it is not black," is true ; but " If an object is not black, it is red," is not necessarily true.

In any case Euclid proceeds on the basis of the assumption that there is only one parallel line in the circumstances mentioned above. He then deduces a few simple properties of parallel lines and proves the well-known theorem that the sum of the three angles in any plane triangle is equal to two right angles. (We shall return to this theorem a little later.) There follow an important series of propositions about parallelograms, or four-sided figures, whose opposite sides are parallel. Thus it is proved that parallelograms on the same base, or on equal bases, and between the same parallel lines are equal in area. (In Fig. 5 the parallelogram ABCD is equal in area to the parallelogram ABEF. In Fig. 6 the parallelogram ABCD is equal in area to the parallelogram EFGH, if AB = EF)

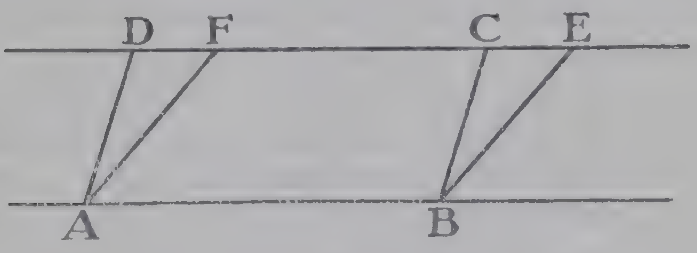


FIG. 5

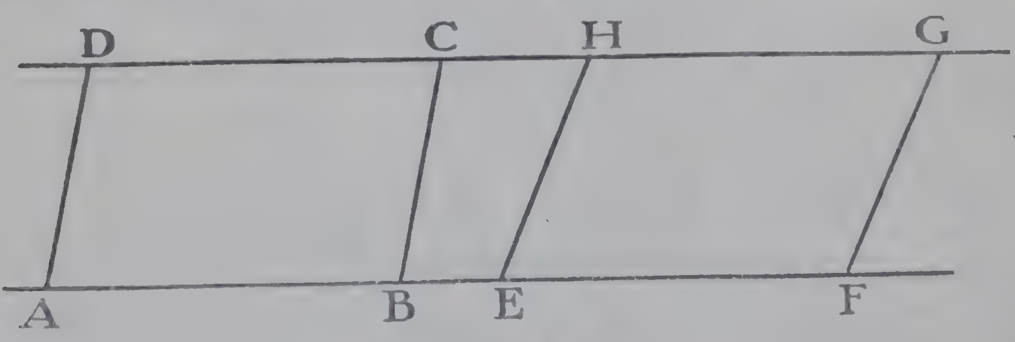


FIG. 6

It is very instructive to note that the treatment here is not *arithmetical* ; *i.e.*, we are not engaged in mensuration. Naturally the reader may wonder how we can treat of equality of areas without " multiplying a length by a breadth"; and if we multiply, surely arithmetical operations are involved. But if he reflects that an *ungraduated* ruler and compasses are the only tools supposed to be available, *measurement* of a length or breadth in any units is out of the question. The truth is that Euclid bases all statements of equality of area on notions of "congruency," or the perfect fitting of figures. Earlier in his first book he deals with triangles which have sides or angles equal in such number as to fit perfectly if superposed one on the other. Thus, looking at Fig. 5, it appears from the propositions proved about parallel lines that the triangle ADF is congruent to the triangle BCE; the former would fit the latter perfectly if "slid over" on to the latter. So the area of the triangle ADF is equal to the area of the triangle BCE, and it is then obvious why one parallelogram has an area equal to the other, without any reference to measurement of length and breadth. A similar type of proof suffices for the other proposition. Note that the statement that AB and EF are equal in length only requires the use of compasses. To proceed, the remainder of the first book continues to deal with areas of figures, especially with the equality in area of triangles on the same base or on equal bases, and between the same parallel lines. Again it should be noted that mensuration and arithmetical operations on numbers are not involved, and that the whole validity of his procedure is based on the assumed truth of his parallel postulate. The first book closes with a beautiful proof of the famous theorem, discovered two centuries earlier by Pythagoras, concerning the squares on the sides of a right-angled triangle. This proof is probably Euclid's own.

The second book deals with some important propositions about the areas of rectangles. Each of these is an analogue of an important proposition in Algebra, and probably nothing will give the reader a clearer conception of the different spirit in these two abstract sciences, Geometry and Algebra, than a reference to one of these propositions.

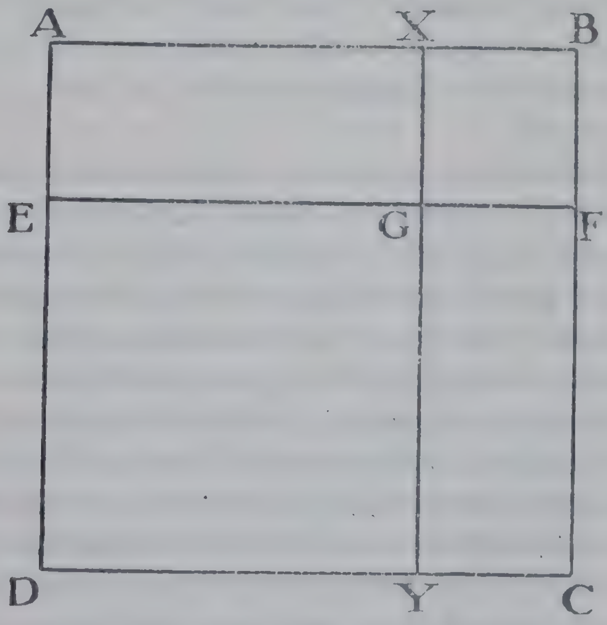


FIG. 7

Divide the line AB at any point X into two parts. Construct the square ABCD and the square XBFG. Complete the figure as shown, and it is not difficult to prove in the *pure geometrical* manner that the square on AB is equal in area to the sum of the areas of the squares on AX and XB and of twice the area of the rectangle contained by sides equal to AX and XB. (The figure itself almost shows it intuitively without the formal steps in the argument.) The analogous proposition in Algebra is mentioned in the previous chapter, namely :

$$(a + b)^2 = a^2 + b^2 + 2ab$$

as is obvious, if we suppose AX and XB, measured by a *graduated* ruler, to be a inches and b inches respectively and the ordinary mensurational rules applied.

The third and fourth books deal with the general properties of circles and of certain rectilinear figures which can be inscribed in a circle, or circumscribed so that all the sides touch a circle. The fifth book is one of the most subtle chains of reasoning known to man, dealing with the connection between number and magnitude, and the conception of ratio, *but entirely independent of the arithmetical operation of division*. It is generally regarded as one of the most difficult books in the *Elements* to follow, and in most modern editions considerable changes are made in the presentation so as to render the study of it a simpler matter for the tyro. The modifications introduced by the famous nineteenth century mathematician, de Morgan, are frequently adopted. The propositions of the fifth book are really necessary in order to deal satisfactorily with the geometry of similar figures which bulks large in the sixth book.

In these six books Euclid deals with the geometry of figures in a plane. Later in the eleventh, twelfth and thirteenth books he deals with the geometry of solid figures in three-dimensional space, treating the properties of cubes, prisms, pyramids, spheres, etc., in an analogous manner to that used for the plane figures and, in particular, treating the volumes of figures, without appeal to mensurational rules based on measurements of length, height and breadth. The books between the sixth and the eleventh are largely concerned with propositions of an arithmetical and algebraic nature, and are usually omitted in the printing of modern editions of the *Elements*.

In order once more to emphasise the abstract nature of Geometry let us recur to the question of parallelism. From Euclid's postulate we can prove that the sum of three angles of a triangle is equal to two right angles. Now is this really true of any plane triangle having its three corners at points in our physical space ? No doubt careful drawing and measurement on a large sheet of paper reveals no discrepancy that cannot be put down to lack of precision in our instruments. Every land-surveyor, every constructor of an ordnance map, uses this proposition and finds no inconsistency in his results. The astronomer uses the rule to find the distances from the Earth of Sun, Moon and planets and a few of our nearest neighbours in the stellar galaxy. But, be it noted, *only a few*. The instruments he employs are sufficiently precise to carry him to about 1,000 billion miles with any degree of confidence in his results. The immense majority of the stars in the heavens are beyond that limit, and any guesses which he makes at their distances employ certain results of Physical Science, in addition to Geometry, as a guide. In short, the geometrical result *cannot be tested* *for immense triangles*. Now in the nineteenth century certain mathematicians, Gauss in Germany, Lobatschewski in Russia, and Bolyai in Hungary, gave up the attempt to prove Euclid's postulate and proceeded to deduce what would be true if there were other lines through a given point than the one considered by Euclid which are parallel to a given line (lying in the same plane, of course). A perfectly consistent Geometry is the result, but one in which certain conclusions differing from those in Euclid's *Elements* are deduced. For example, in this Geometry the three angles of a triangle are together less than two right angles and the defect of the sum under two right angles grows larger and larger as the size of the triangle increases. There is also a system of Geometry due to a German mathematician Riemann, which postulates that to any given line there exists no parallel line at all, that any line in the same plane must meet it somewhere. This Geometry, as a matter of fact, begins altering Euclid's postulates at an earlier stage than the parallel postulate so as to invalidate his proposition that the sum of two angles of any triangle must be less than two right angles. With his system of postulates Riemann could deduce that the three angles of a triangle are together greater than two right angles of a triangle, the excess growing larger as the size of the triangle increases.

Turn for a moment to another proposition, the Pythagorean theorem concerning a right-angled triangle. The proof of this is also dependent on acceptance of Euclid's parallel postulate. Without this the theorem cannot be deduced. Now this theorem forms the basis of a whole series of mensurational formulæ which are in daily use for many practical purposes and lead to no inconsistency. To be sure the theorem is not true in its simple form for an extended triangle drawn on the Earth's surface, but of course such a triangle is not a *plane* triangle, and in any case the mathematician can deduce from the assumed truth of the theorem for a triangle in a plane, what modifications must be introduced into the surveyor's and the navigator's formulæ in order to render them theoretically valid and therefore presumably correct in practice. Yet there remains the question of interest to the scientist and philosopher, if not the practical man—is the theorem really valid in our physical space ? As far as we can judge, for relatively small plane triangles it is practically true, but does the validity extend to enormous triangles ? In fact the situation is similar to that in which the theorem about the three angles of a triangle finds itself on strict scrutiny, and again the conclusion is inevitable ; if the parallel postulate of Euclid is abandoned and another postulate replaces it, the usual statement concerning a plane right-angled triangle will not be true and another result will take its place, of a rather more complicated nature, concerning whose exact form we cannot speak now.

Clearly the situation calls for the *experimenter*, physicist or astronomer, and it takes no elaborate argument to convince one that the problem is beset with many difficulties of a theoretical as well as a practical nature. True the practical man, satisfied with the well-tried accuracy of his conclusions on the surface of the Earth, and hearing that after all if there are any discrepancies to be found when the astronomer plumbs the depths of our physical space they are minute, may shrug his shoulders at the manner in which men of a different temperament worry themselves over

" trifles." But to the scientist and philosopher this is no trifle. Philosophy faces many problems concerning man's nature, but one of its oldest tasks and one which has engaged the minds of some of the greatest thinkers, is just the nature of our physical space and time, and in connection with that these geometrical results which we have been discussing play a vital part. To clear away any possible misconception on the part of the reader concerning the exact nature of the dilemma, we must warn him that there is no question of Euclid being " wrong." Our space may very well be " non-Euclidean " ; but that does not affect the question of the correctness and consistency of Euclid's propositions as logically and systematically developed by him *from his axioms and postulates*. As an exercise in reasoning on *abstract* entities such as points, lines and planes, etc., his Geometry is perfectly valid. Whether there exist in our physical space any *material* entities enjoying the properties deduced for points, lines, etc., is a matter for the experimental scientist ; it is of no interest to the mathematician as such. The fact that his deductions do in fact have a close relation with actual things is a fortunate circumstance and one which is of tremendous importance to man as accountant, builder, engineer, physicist or astronomer ; but it is all one to the " pure mathematician " whether his conclusions have a practical application or not.

Howbeit, although it digresses for a moment from our true purpose in this article (which is to analyse and describe the purely mathematical processes of the reasoning mind), the reader will possibly be interested to know how matters stand with regard to the scientific problem just indicated. The most serious difficulty of a practical nature facing the experimentalist is that all the bodies in our space whose observable geometrical relations are under investigation, are not at rest but in relative motion to one another. (After all, in the purely mathematical consideration of a geometrical problem the configuration of the points, lines, etc., in the figure remain unchanged.) This would not be so troublesome a feature if one perceived the bodies in the same places as they actually occupy at the moment of perception ; but this is not so. When we look at the Sun we see it to be where it was some eight minutes earlier, because it takes eight minutes for light to travel from Sun to Earth. Furthermore, because of the different distances from us, the lag of time between the location of a body in a place and the perception of that location varies from body to body. The problem has in very recent years been placed on an entirely new basis by the discovery that the behaviour of light does not copy in detail the motions of bodies or of waves in deformable media (views prevalent in the previous century or two). On the basis of this newly ascertained *experimental* fact, Einstein has laid down a certain broad principle concerning the nature of our scientific laws (it is known as the Principle of Relativity) and has, for the scientist at all events, simplified the position, although there is a very prevalent, but quite unjustifiable, idea to the contrary. This principle has led to certain conclusions concerning the " metrics " of our space, meaning by that the measurable relations connecting observable bodies, and these have been extended to include such great stretches of physical phenomena as are embraced in the terms " gravitation " and " electromagnetism." One of the most unexpected results, evoking the unbounded admiration of those trained to follow the argument, is that, on considering quite dispassionately certain properties of that ultimate particle of matter which we call an "electron," we are almost forced to conclude that our physical space is *finite in size*. There is no paradox about this although, on hearing of such an idea for the first time, an unsophisticated man probably enquires, What is the nature of the "boundary" or "wall" which limits its size? But a moment's reflection shows us that there need be no boundary; the surface of the earth is finite in size yet there are no boundaries; we can, apart from physical difficulties of transport over mountains and polar wastes, go round it in multitudes of different paths. We naturally feel at the first blush that this analogy is not quite sound; we can *conceive* in a direct, intuitive way how the earth's surface may be finite and yet "unbounded,"[1] because we have *direct perception* of such things as oranges, balls, etc. No such direct intuition is available to us in the case of "finite but unbounded space." Yet the inference that it is so is quite as definitely based on observable experimental results as the conclusion about the earth's surface. Putting it quite definitely, if somewhat crudely, the physicist and astronomer believe, on what they regard as perfectly irrefutable evidence, that if a being could somehow ferry himself across space and survive for an enormous number of years, and always continue along what he *would believe to be a straight line*, he would in time arrive somewhere near his starting-place. (We often talk about going "in one direction" on the Earth; but of course the mariner steering "dead straight" on his shortest course from one place to another travels not along a straight line but along a "great circle" of the Earth's surface.) The physicist also makes a shot at what the length of his journey would be—ten thousand trillions (10^{22}) of kilometres!! The mind shrinks, appalled, at such a figure, yet it is not *infinite*.

If this be so, we have an answer at once to the question, Is Euclidean Geometry valid in our space?—and it is "*No!*" This is what is meant when one reads nowadays about "curved" space. The use of that phrase implies that the conclusions of Euclid's system of Geometry are not found to be true in our space. The agreement observed in our terrestrial measurements, or in regions not too far extended from the Earth, rests on the restricted nature of such observations, just as a small sheet of water on the Earth appears flat while the ocean is obviously curved.

Even before the advent of the Relativity Principle, there were certain considerations of a more speculative character which pointed to a similar conclusion. If one assumes our space to be infinite in extent, we must ask ourselves if it is in all its extent populated with galaxies of stars similar to those which we know to exist relatively near to us. Now the answer to such a question raises serious difficulties for the notion of infinite space. Suppose, for example, we admit that the stars are not "innumerable," *i.e.*, not really infinite in number, nor greater than some conceivable number. Then there is a finite number of them. We can conceive that they are distributed, in much the same way as the stars we know, in some finite portion of space—enormous no doubt, but still finite and therefore *as nothing* compared to infinite space. This state of affairs cannot last; in time, as can be readily shown from statistical considerations and the ordinary laws of motion, the stars will gradually spread themselves, becoming less and less densely distributed in space, until after the lapse of a time, enormous no doubt, but *finite*, any small group of stars like our solar system would find itself without a neighbouring star within sight. Now, philosophically, we have no less reason for postulating infinite time than we have for postulating infinite space, with the result that we find it difficult to account for the fact that we here and now obviously have very many neighbours in the heavens.

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[1] There is a poetical use of the word "unbounded" which makes it practically synonymous with "infinite." That is not intended here; it is used with its true meaning—"having no boundaries."

If, on the other hand, we agree to regard the stars as really infinite in number, and any part of space, however distant from us, as inhabited by galaxies like our own, we are in no better case. The laws of gravitation and light propagation, as discovered by the physicist, lead to the conclusion that at all times our heavens would be an intolerable blaze of light compared to which sunlight would be a feeble flicker, and the gravitational forces on us would be infinite in value and rend the earth into the tiniest fragments.

It is true that the full force of these conclusions could be evaded by *ad hoc* assumptions involving the existence of absorbing, partially opaque matter in space and small modifications in Newton's law of gravitation. But, as already indicated, Einstein's great principle, with its amazing result concerning a connection between the size of our Universe and the electrical theory of matter, has clinched the argument.[1]

It is time to return to our study of purely mathematical reasoning.

LIMITS: THE CALCULUS: PERIODICITY

Mathematics based on abstraction of number and form is admirably suited to the symbolic representation of a static world; but to take account of the flux of events a further element is needed. The discovery of this was a modern achievement, though the germ of the method may be found in the work of Archimedes, the famous Greek mathematician who lived in the third century B.C. The poverty of symbolic methods in his day, however, prevented its growth, and not until the development of algebraic symbolism in the sixteenth and seventeenth centuries could the conception of "fluxions" be embodied in a specific notation, which is due in part to Newton and in part to Leibniz.

The most obvious example of change in our world is motion, or change of position. A body is now in a certain position, but it is moving; it has a certain speed, we say. To give the physically essential information about the body we must state its position and its velocity of movement. The former is a matter of geometry. What about the latter? Can we really say anything about its speed *at an assigned position*? On the face of it we can apparently only refer to speed *between two positions*. These two positions are separated by a measurable distance, over which the body travels in a measurable time. We divide the distance by the size of the time interval to obtain the speed; that is the meaning of "speed," and with reference to one position only this operation is clearly impossible. So the phrase " speed at an assigned place " appears to be meaningless. As a matter of fact, the logical difficulty involved in such considerations so impressed certain Greek philosophers in ancient times that they devised several ingenious paradoxes meant to prove that motion is an illusion of our senses. (The interested reader can look up an encyclopædia on the philosopher Zeno of Elea for further information.) However, modern mathematics has completely swept aside these verbal quibbles.

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[1] A further discussion of the Theory of Relativity will be found in the Articles on *The Physical Nature of the Universe*, p. 99, and *Astronomy*, p. 120.

In order to illustrate the way in which mathematics has extricated us from this awkward situation, let us consider a very simple type of motion. If one rolls a smooth ball down a groove on an inclined board, it can be demonstrated, by modern physical apparatus, that a simple law connects the distance and time. If the body travels, say, 3 inches in the first second of motion, it will travel 12 inches in the first two seconds, 27 inches in the first three seconds, after four seconds it will be 48 inches away from its starting-point, and so on. The essence of the law lies in the fact that 12 inches is four times 3 inches and 4 is the square of 2 ; 27 inches is nine times 3 inches and 9 is the square of 3 ; 48 inches is sixteen times 3 inches and 16 is the square of 4. One may tilt the board to different inclinations without varying the essential physical fact embodied in this " square law." Thus at a somewhat greater inclination the ball might roll 5 inches in the first second ; it would then roll 20 inches in the first two seconds, 45 inches in the first three, and so on.

Naturally we cannot actually observe the ball at *any* instant ; our moments of observation are limited in number and separated by discrete intervals of time, which are shorter no doubt if we devise ingenious timepieces, but cannot be indefinitely reduced in size. We now make a new kind of abstraction from the facts. We assume that what we have observed to be true for a limited group of positions and instants is true for *any* instant and its corresponding position. We invoke the " Principle of Continuity " in natural events, and embody our observations and the assumption in the phrase :—" the distance varies as the square of the time." We can, however, embody them much more succinctly in an algebraic formula. Represent the distance covered in one second from the start by a inches ; then the distance covered by the ball in x seconds from the start is ax^2 inches. Note that x may be any number of seconds we like, integral or fractional. (Provided of course it is not so great that the ball has rolled off the board ; but even then we can conceive a very long board to be at our disposal.) The speed between two instants can now be calculated by applying well-known algebraic results. Suppose it has taken x seconds to travel to a position which we refer to as the position P ; it takes a larger number of seconds, say z, to travel to a position beyond P which we refer to as Q. Thus it takes $z - x$ seconds to travel from position P to position Q ; the distance between P and Q we obtain by subtracting ax^2 from az^2, the result being $az^2 - ax^2$ or $a(z^2 - x^2)$ inches. To obtain the speed from P to Q, *i.e.*, speed on the average, we divide $a(z^2 - x^2)$ inches by $(z - x)$ seconds and this is written

$$\frac{a(z^2 - x^2)}{z - x} \text{ inches per second.}$$

Now what is the speed *at* the position P. Here we meet the difficulty referred to. The position of the body at P is perfectly definite ; it requires no reference to any other position of the body ; it is a question of " simple location," as the philosophers call it ; the body is there and nowhere else. But speed requires some reference to another position, apparently, or we seem to make nonsense of the business. We cannot talk about the speed from P to P ; if we do we must make z equal to x in the formula written down above and it becomes

$$\frac{a\,(x^2 - x^2)}{x - x} \text{ inches per sec.}$$

$$\text{which is } \frac{0}{0} \text{ inches per sec.}$$

a perfectly meaningless operation apparently. But there is one way of escape. No matter how near Q is to P, so long as they are actually different positions, z differs from x and the formula has a meaning and can be evaluated numerically, provided numbers are assigned to z and x. Is there a limiting value to the quotient in the process as z is reduced in value nearer and nearer to x ? Let us recall the simple factorisation we referred to in the section on Algebra :—

$$z^2 - x^2 = (z - x)\,(z + x).$$

So
$$\frac{a\,(z^2 - x^2)}{z - x} = \frac{a\,(z - x)\,(z + x)}{z - x}$$

and the right hand side is just $a\,(z + x)$ since $z - x$ in the denominator cancels the factor $z - x$ in the numerator. Now $a\,(z + x)$ *is not meaningless* when z is made equal to x ; its value is then $a\,(x + x)$ or $2ax$. This then is taken as the speed of the body at P, *viz.*, $2ax$ inches per second. The point is that as we think of a position Q nearer and nearer to P, the speed from P to Q is approaching to $2ax$ inches per second closer and closer as a limit, and this limiting value gives us our correct idea of speed at P.

But now the pure mathematician steps in and says :— " It is true that this process has been suggested to us by our need to deal scientifically with the physical world ; but after all this process can be applied to all sorts of functions of the variable x without any reference to material things at all. It has an interest of its own which is purely intellectual ; there are definite mathematical laws which it obeys by reason of the definition of the process and our own mental make-up." Thus we can apply the process equally well to x^3 as to x^2. Let us change a variable from a value indicated by x to a value indicated by z ; another variable, which is the cube of the first variable, changes in value from x^3 to z^3. The relative change in the second variable to that in the first is

$$\frac{z^3 - x^3}{z - x}.$$

This ratio has a meaning so long as z differs from x. As before it appears to have no meaning when z is equal to x, since it becomes $\frac{0}{0}$.

But again we can factorise the numerator and *one of the factors is* $z - x$.

The factors are $z - x$ and $z^2 + zx + x^2$, as the reader can easily justify. Hence :—

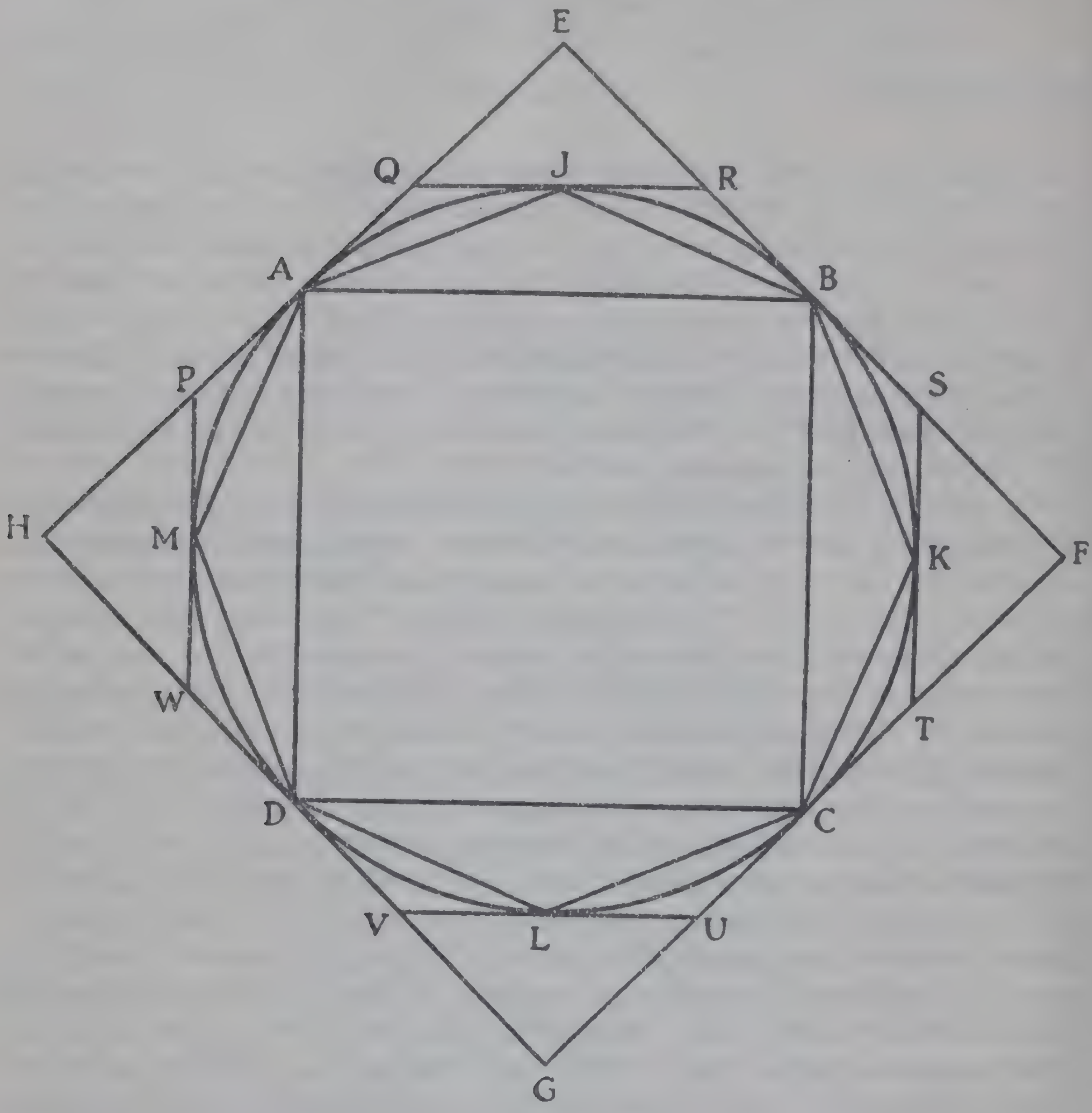
$$\frac{z^3 - x^3}{z - x} = \frac{(z - x)(z^2 + zx + x^2)}{(z - x)}$$

and this is just $z^2 + zx + x^2$.

As before just in the condition where no meaning can be attached to $(z^3 - x^3)/(z - x)$, the alternative expression $z^2 + zx + x^2$ has a perfectly precise meaning, *viz.*, $3x^2$; for on putting z equal to x we get $x^2 + xx + x^2$, *i.e.*, $3x^2$. In exactly the same way the mathematician will prove to you that this process will produce $4x^3$ from x^4, $5x^4$ from x^5, etc.; in general nx^{n-1} from x^n. He gives the process a special name, " differentiation." He calls the result a " differential coefficient." Thus the " differential coefficient " of x^2 with respect to x is $2x$; of x^3 with respect to x, $3x^2$; of x^n with respect to x, nx^{n-1}.

As may be anticipated, the mathematician finds that this process of differentiation can be applied to the most complicated functions of a variable. He has invented a special notation and symbolism for it. A very wide literature on the " Differential Calculus " has come into being in the last three centuries, embracing extremely exhaustive and very subtle discussions on the validity of the process in special cases, and an amazing number of purely intellectual problems meant to test the skill and ingenuity of the learner. More than that, just as this calculus sprang from the needs of the physicist, so in its most highly developed form it has returned to him, giving him an amazing power in the mathematical treatment of his observed phenomena. Without it he would be helpless in the face of the ever changing conditions of our world; he would be powerless to work out the quantitative aspect of these phenomena; indeed he would be without the means to formulate his laws in their most general significance. We hear of the " equations of motion," the " equations of the electromagnetic field," the " equations of gravitation," the " equations of wave propagation " and so on. Now the reader should know that these are not equations of the simple type referred to in the section on Algebra, they are " differential equations," *i.e.*, equations connecting the differential coefficients of symbols representing various physical quantities with respect to variables on which they depend, such as time and " co-ordinates of position "—" co-ordinate " is the name given to any measure of length or angle which helps to define where a point is situated with reference to a standard point of reference or " origin."

Nor is this the only aspect of those processes in Mathematics which " work to a limit." We have seen in the section on Geometry how Euclid treated distance apart of two points without introducing a *graduated* ruler as part of his postulated appliances. He was not a " mensurator," but a geometer. Now how could we treat the length along a curved line between two points marked on it in a similar way? The natural impulse is to seize a thread; lay it as carefully as possible along the curve, lift it, stretch it out and place it so tightened beside a ruler. It is a familiar practical operation; but that is mensuration, not geometry. The geometer proceeds as follows. Taking a circle as the easiest curve for simple illustration, we can suppose that inside the circle we inscribe a square ABCD and outside it we circumscribe a square EFGH as in the figure below.



The length of the circumference obviously lies between the values of the perimeters of the two squares. Now increase the number of sides of the inscribed figure so as to obtain an inscribed octagon AJBKCLDM and a circumscribed octagon PQRSTUVW. The circumference lies between the perimeters of the two octagons, and the limits are nearer to one another. We can conceive of this process being carried on until the inscribed and circumscribed regular polygons have each an enormous number of sides, each side being extremely short. Always the circumference lies between the two perimeters, and as the difference between these two perimeters is clearly diminishing to an infinitesimal amount, we regard the length of the circumference as the common *limit* to which each perimeter approaches as near as we please as we increase the number of sides indefinitely. Of course, it must be realised that the measurement of the sides of such a polygon by a *graduated ruler* is not implied nor required. (That would just be as much mensuration as using a thread on the actual curve.) Euclid, in his fourth book, has proved certain propositions about such inscribed and circumscribed polygons which, when assisted by similar propositions discovered by later geometers, enable us to compare the length of a side of such a regular polygon with the length of the radius without resort to measurement of either. The circumference is, as the mathematician says, the " integral " of the infinitesimal lengths for the polygon with the unlimited number of sides, and the process he refers to as " integration." Similar processes can be applied to all other curves, and indeed to problems in a multitude of situations of quite a different character from this example, and the works describing methods and results are called text-books of the " Integral Calculus." With reference to the example shown, the reader should know that when he reads that the value of π (the famous Greek symbol which stands for the ratio of circumference to diameter) has been worked out to so many places of decimals, he must not imagine that it has been done by mensuration. A thread method as described above would barely give the first three places correctly. Even to obtain 3·14159 the integration process as described above or in some alternative way has to be employed, and it is only a matter of patience to carry the decimal much further.

Another illustration of the use of the notion of a limit is contained in the following statement. I write down the following fractions : $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{16}$, $\frac{1}{32}$ and so on, each fraction having a denominator twice as large as its predecessor in the series ; now I add them travelling on indefinitely, that is I " sum the series "

$$\tfrac{1}{2} + \tfrac{1}{4} + \tfrac{1}{8} + \tfrac{1}{16} + \tfrac{1}{32} + \ldots .$$

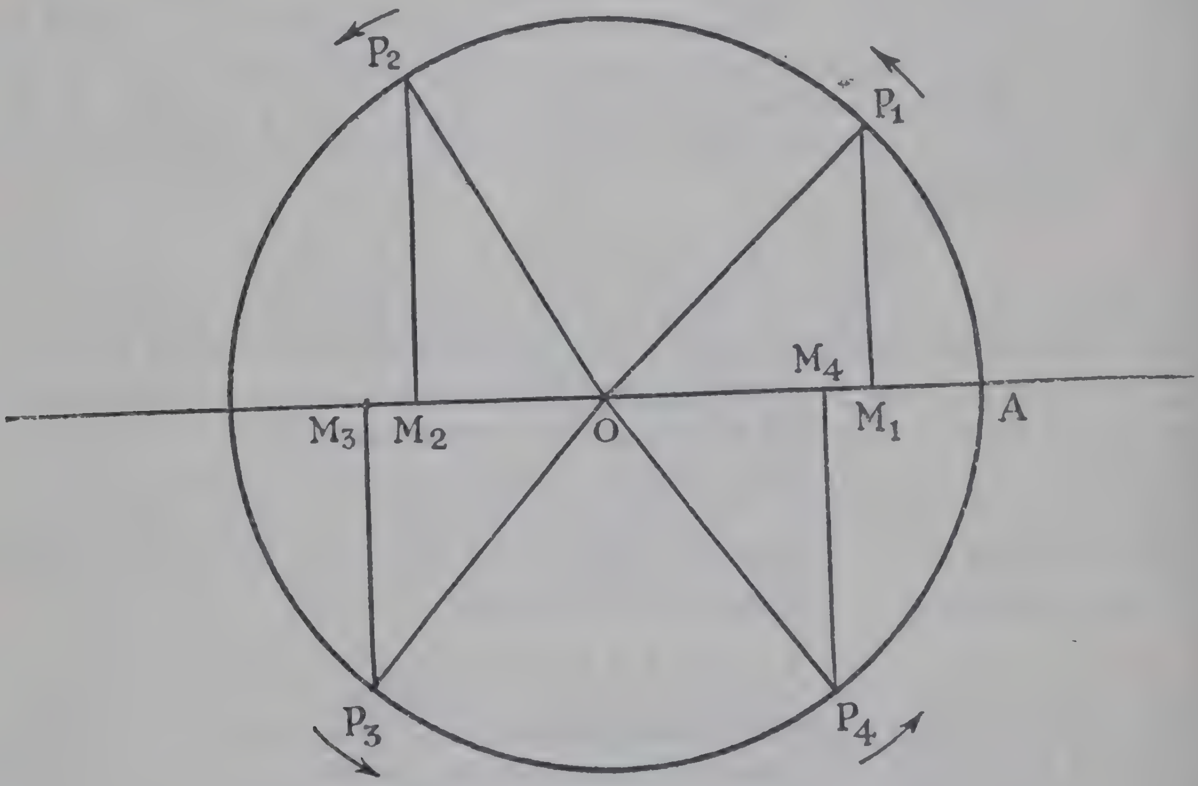
No matter how far I travel along I never reach a number as great as 1 for the result of the addition. True, I can approach as near to unity as I like by taking a sufficiently great number of " terms." As the mathematician says, the limit of the sum of the series is unity when it is " summed to infinity." Now it is perhaps natural to suppose that this series behaves like this, is " convergent " (to employ the usual phrase) simply because the successive terms are getting smaller and smaller. This is a complete misapprehension. If I write down the series

$$\tfrac{1}{2} + \tfrac{1}{3} + \tfrac{1}{4} + \tfrac{1}{5} + \tfrac{1}{6} + \ldots$$

it enjoys no such property of " convergency " ; it is " divergent " ; *i.e.*, there is no limit to the value of its sum if one embraces a large enough group of terms. Write down any number you please, no matter how large, and the sum can be made to surpass that number by adding up a sufficiently great number of terms. That may appear an astonishing statement to those uninitiated in these matters, but the proof of its truth is unassailable and may be found in any text-book of Algebra which has a chapter on " Convergency and Divergency of Series." Yet this series shows a progressive decrease in the values of the successive terms, just like the previous one. Obviously, then, the test for the convergency of a series is more delicate than that suggested above as plausible. Indeed the study of the tests for convergency and the limiting sums of series that are convergent form a branch of mathematical analysis which is not only invaluable in the study of the properties of functions (a purely mathematical interest), but is also of immense practical value to those who wish to apply mathematical analysis to scientific and engineering problems. As is always the case, every new branch of mathematical investigation takes its rise in some practical need of man, then develops on its own account, as it were, by reason of his purely intellectual interests, and in so doing becomes a still more powerful aid to him in his control over the forces of the world and in his investigation into their nature and origin.

As one last illustration of this statement, let us recall the fact that many phenomena of nature show a recurrence of certain features as time goes on; they are periodic, as we say. Examples such as the recurrence of light and darkness, of the seasons; the rise and fall of the sea level in tidal seas and estuaries; the daily and seasonal fluctuations of temperature will leap to the mind of the reader. Many mechanical occurrences such as the swing of a clock pendulum, the oscillation up and down of a body at the end of a spring, the motion of water as ripples or waves pass across its surface exhibit the same features.

Consider for a moment the behaviour of a point which travels round the circumference of a circle at a uniform rate.



Starting at the point A, let it move round and let us denote by x the distance along the arc which it has actually travelled from the start to any position. We are for convenience considering the circle to have as its radius the unit length, so that when the line OP has turned round a right angle, $x = \pi/2$ (π is ratio of circumference to diameter), when OP has turned two right angles $x = \pi$, and so on; in fact x goes on steadily increasing; it is a variable which increases by the amount 2π in every complete journey of P round the circle. Now drop a perpendicular PM on the line OA. The lengths of PM and OM vary as x varies. They also are variables as well as x, but depending on the value of x, " dependent variables " as they are called. They are in fact functions of x; the mathematicians call them " circular functions " of x. Actually they have long been in use as important measures of the angle POA, the " sine " and " cosine " of the angle as they are named. They originated in the needs of the surveyor and the navigator, and they are familiar to every navigating officer. But from the mathematician's point of view they are the " sine function of x," and the " cosine function of x," written $\sin x$ and $\cos x$ for convenience. Now the reader will observe at once that they are periodic functions of x, repeating their value when x increases by 2π. As x increases from 0 to $\pi/2$, the value of $\sin x$ is given by a length such as P_1M_1 at the appropriate position of P. It begins with the value zero when x is zero, and reaches the value unity when x is $\pi/2$. As x increases from $\pi/2$ to π, $\sin x$ (indicated by P_2M_2) decreases from 1 to 0. As x increases from π to $3/2$, $\sin x$ changes in value from 0 to -1, having negative values for all intermediate values of x. (Observe that M_3P_3 is directed oppositely to M_2P_2 or M_1P_1.) As x increases from $3\pi/2$ to 2π, $\sin x$ alters from -1 to 0. Now as x increases from 2π to $5\pi/2$, $\sin x$ proceeds to pass through the same series of values as it did when x lay between 0 and $\pi/2$; and so on. Similar conclusions can obviously be drawn for $\cos x$. In fact if we give x any particular value, say 3,

$$\sin 3 = \sin(3 + 2\pi) = \sin(3 + 4\pi) = \sin(3 + 6\pi) \text{ etc.}$$

and

$$\cos 3 = \cos(3 + 2\pi) = \cos(3 + 4\pi) = \cos(3 + 6\pi) \text{ etc.,}$$

and any such statement is true for any other numerical value of x that may be chosen.

Actually then we have in these functions the most simple example of a wide range of functions of x, which enjoy this property of periodicity, or recurrence of value, as x steadily increases in value. To relate this fact to a statement concerning series made a few pages back, it is interesting to know that the mathematician can prove that the series

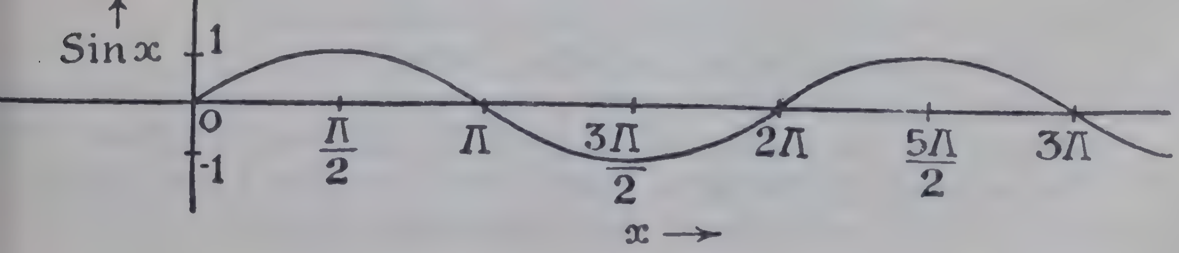
$$x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \frac{x^9}{9!} - \frac{x^{11}}{11!} + \dots \text{ to infinity}$$

is convergent and its limit is $\sin x$. (Note that in putting the exclamation mark after the numbers in the denominator, we are indicating not the number but the " factorial of the number " as it is called. That is $2! = 1 \times 2$, $3! = 1 \times 2 \times 3$, $4! = 1 \times 2 \times 3 \times 4$, and so on.) The series

$$1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \frac{x^8}{8!} - \frac{x^{10}}{10!} + \dots \text{ to infinity}$$

is also convergent and its limit is $\cos x$.

If we make a graph of the function $\sin x$ in the usual way, we reproduce the well-known " wave form."



In conclusion, these functions and others like them are the symbolic material which the mathematicians use when they wish to represent, in the only way possible, the quantitative aspects of the broad periodic phenomena of nature and of the experiments of the physicists made to discover the nature of those occurrences within the atom which give rise to the emission of light and which are believed to be periodic, or the nature of the propagation of light, or the nature of molecular quiverings in bodies which are believed to be the essence of the thermal properties of matter.

And so we end as we began. The material needs of man have, in the process of their satisfaction, raised for him purely intellectual problems. Driven by some inner urge to solve these, with no ulterior motive of any sort, he finds to his ever increasing astonishment that in their solution he discovers weapons which multiply his power over his environment a hundredfold. Intellectual pursuit as it is, Mathematics is of the very essence of the human spirit, and the literature in which it is enshrined ought to be one of man's proudest possessions.

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BIOLOGY AND HUMAN PROGRESS

By

J. ARTHUR THOMSON

SYNOPSIS

What Biology means — Its central position among the sciences — Sub-divisions of Biology, *e.g.* Botany and Zoology — Sub-sciences of Biology, namely Morphology, Taxonomy, Physiology, Ecology, Embryology and Palæontology, Ontogeny and Phylogeny — An Outline Survey of the Great Events in Biology — The idea of Science as an instrument in man's service — Theoretical Discovery and Practical Invention — The Appeal to Biology as a science is very modern — Biology and Human Life : its Contributions : (i) Alleviation of the struggle for existence and increase of food and elementary amenities ; (ii) conquest of disease and increase of positive health ; (iii) elucidation and solution of great practical problems, *e.g.* of sex ; (iv) as a means of culture ; (v) as a foundation for eugenics ; (vi) as of ethical suggestion and guidance ; (vii) in forming part of the materials to be appreciated in a synoptic or philosophical view — Biology and Philosophy — The Wonder of Life, *e.g.* (1) the abundance of power, (2) the multitudinousness and diversity of organisms, (3) the intricacy of organic architecture, (4) the adaptiveness of living creatures, (5) positive and exuberant healthfulness, (6) the increasing dominance of mind, and (7) the fact of Evolution — Descriptive Naturalism — Vitalism — Psycho-Biology — Organic Evolution and the operative factors — As regards Variations — As regards Heredity — Struggle and Selection — Isolation — Evolution going on.

BIOLOGY AND HUMAN PROGRESS

The term Biology is used in three or four different ways. (1) It may mean the generalised science of the nature, continuance and evolution of organisms, and it is in this sense that it is for the most part used in this article, just as in Spencer's classic *Principles of Biology*. (2) But it is often used as a collective term for all the Life Sciences, which include Botany, Bacteriology, Zoology, Protozoology and so forth, and also for the biological sub-sciences of Anatomy, Physiology, Embryology, Genetics and the like. Thus in one great University all the sciences or sub-sciences that we have mentioned are under one roof—the Biological Institute or the Hall of the Life Sciences.

(3) An English book entitled *The Biology of Spiders* or *The Biology of Flowering Plants* would contain a discussion of the group in question in order to illustrate in this particular field the general principles of Biology. (4) Unfortunately, however, a German book entitled *Die Biologie der Spinnen* (The Biology of Spiders) would be entirely devoted to Ecology, that is to say, the study of inter-relations and habits, adaptations to seasons and surroundings, the intimate life of the pair, the family and so on—in short, the old-fashioned Natural History. This fourth usage is unfortunate and should not be allowed to impose itself. The first two usages are necessary and convenient.

Biology is central among the concrete sciences, with Chemistry and Physics (hardly separable now) beneath it and fundamental to it; with Psychology and Sociology above it and fundamentally based on it. Thus we have the convenient Spencerian scheme :—

SOCIOLOGY	Societies and their Life
PSYCHOLOGY	The Inner or Subjective Life
BIOLOGY	Living Organisms
PHYSICS	Energy and its Transformations
CHEMISTRY	Matter and its Changes

Yet in some ways it seems clearer to recognise only three great Orders of Facts :—

1. The *Cosmosphere* of non-living things and forces, from dewdrops to stars, from electricity to gravitation.
2. The *Biosphere* of living organisms, both plants and animals ; and
3. The *Sociosphere*, consisting of human societary forms acting as units, and with a dominant social heritage, enregistered in institutions, literature, art, traditions, and all sorts of permanent products.

This threefold classification has certain advantages; *e.g.*, that Chemistry and Physics are no longer readily separable, for Matter has been analysed into Energy; and similarly that Biology and Psychology (regarded as the science of behaviour) are inextricably intertwined. Thus we may think of three circles one within the other :—

(1) The domain of non-living things and forces (Cosmosphere).
(2) The realm of organisms (Biosphere); and innermost
(3) The kingdom of man (Sociosphere).

The inclusion of one circle within the other will suggest the useful idea that there is a chemistry and physics of the living body, just as there is a biology and psychology of societary changes. When beavers make a canal, the biosphere is taking part of the cosmosphere into its realm; when man irrigates a country like Egypt or India, he is doing the same. When microbes cause a plague, the biosphere is overwhelming part of the sociosphere; yet when man domesticates and cultivates he is taking part of the biosphere into his kingdom.

SUB-DIVISIONS OF BIOLOGY

It is a matter of convenience how many Biological Sciences we recognise. Everyone admits Botany for plants and Zoology for animals, but as specialisation of study increases, it becomes plain that Bacteria are very different from all other living creatures, and thus Bacteriology arises; whereupon the specialists on unicellular animals insist also on Protozoology; and Protistology is further suggested as a title for the study of those minute organisms which are not very definitely plants, or animals, or bacteria. Then each class asserts its claims, and Entomology, Ichthyology, Ornithology and so forth get a footing on the list. And so for the science of special groups of plants, such as mycology for the science of fungi. But here there is no confusion, such as begins to show itself when highly specialised lines of inquiry demand rank as particular sciences; *e.g.*, parasitology for the study of parasitism, conchology for the study of shells, and oology for the study of eggs!

The following scheme should make the matter clear :—

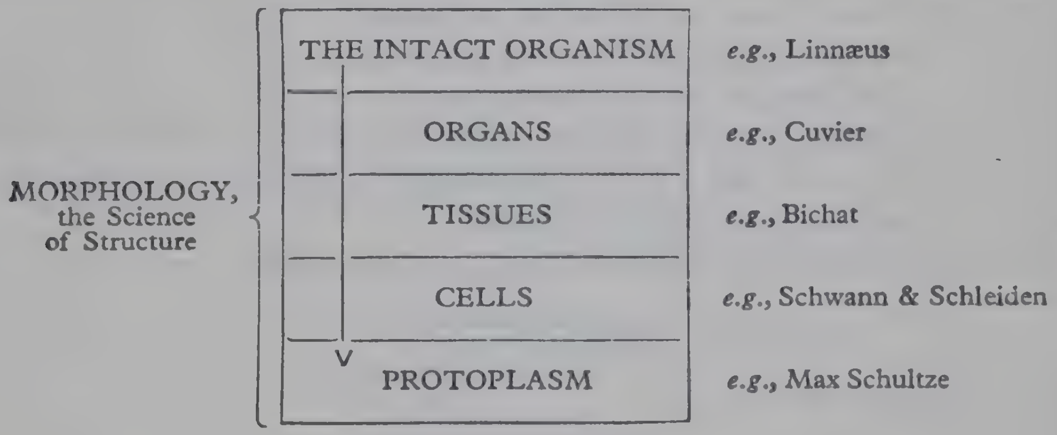
- BIOLOGICAL SCIENCES
  - BOTANY
    - BACTERIOLOGY
    - MYCOLOGY
    - and other sub-sciences
  - ZOOLOGY
    - PROTOZOOLOGY
    - GENERAL ZOOLOGY
      - ENTOMOLOGY
      - ORNITHOLOGY, etc., etc.
    - ZOOLOGICAL ANTHROPOLOGY

There is, of course, room for reasonable difference of opinion in regard to details. Thus there is something to be said for removing Bacteriology from within the rubric of Botany. Or again, while much of anthropology is definitely sociological, the study of man's structure, functions, development and pedigree may be conveniently, and without prejudice, retained under Zoology. It comes to this : that under the collective title Biology (=Life Sciences) a variable number of sciences may be included.

In a different group, however, are the so-called Applied Sciences, such as Agriculture, Veterinary Science, Fisheries, Genetics, Hygiene, and much of Medicine, where we have to do with the focussing of a pure science, or of several pure sciences (Biology included), on a particular group of practical problems. These applications of science have meant much to human progress and also to the advancement of pure science itself. Practical invention often springs from theoretical discovery, and reacts on its origin.

SUB-SCIENCES OF BIOLOGY

There are four great questions that Biology is always asking, and the answers to *each* of these four give rise to two sub-sciences, according as the scrutiny is confined to the individual organism or to the race. The first question is : *What is this?* as a whole and in its parts, to the naked eye or under the microscope. This is the study of structure, the statical aspects of the organism—in a word, MORPHOLOGY. It includes anatomy by means of forceps and scalpel, and histology by means of microscopic sections and other technique. If we begin at what may be called the biological renaissance, with the anatomist Vesalius (1514–1564), " the emancipator of biology from the tradition of the ancients," and with Harvey (1578–1657), the demonstrator of the circulation of the blood, we may sum up the subsequent analysis of structure as a more and more penetrating analysis of the organism into its organs, its tissues, its cells, and its protoplasm. We follow our teacher and colleague Patrick Geddes in this scheme, which suggests both the historical and the logical sequence :—



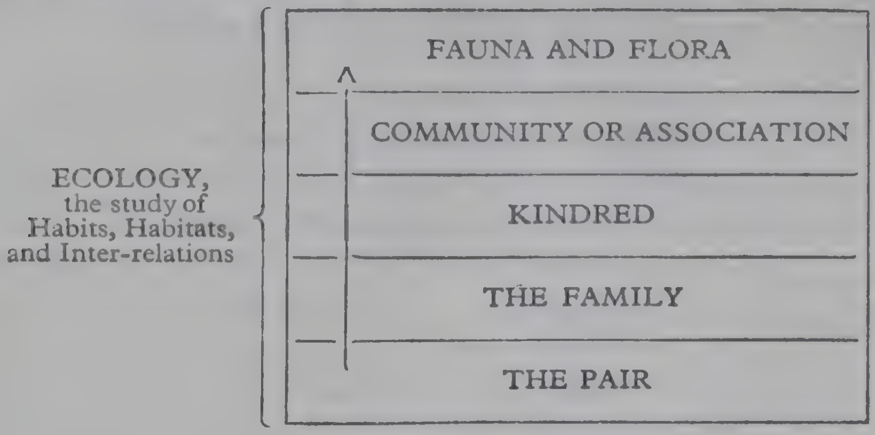
But when we pass from the individual organism to the group or race, we begin the science of orderly arrangement or classification—TAXONOMY, which is based on the study of structure, but rises beyond it. As everyone knows, the tigers form the *species Felis tigris* in the *genus* Felis, which also includes lions and leopards, cats and jaguars. But the genus Felis is not distantly related to the genus of cheetahs (Cynælurus) and together they form the *family* Felidæ. But along with the cats must be ranked the wolves and foxes, the bears and otters, forming the *order* Carnivora. This again is within the *class* of Mammalia in the Group or *Phylum* of Backboned Animals or Vertebrata. So the scheme of classification stands :—

TAXONOMY, the study of Classification	PHYLUM OR GROUP	*e.g.*, Vertebrata
	CLASS	*e.g.*, Mammalia
	ORDER	*e.g.*, Carnivora
	GENUS	*e.g.*, Felis
	SPECIES	*e.g.*, Felis tigris

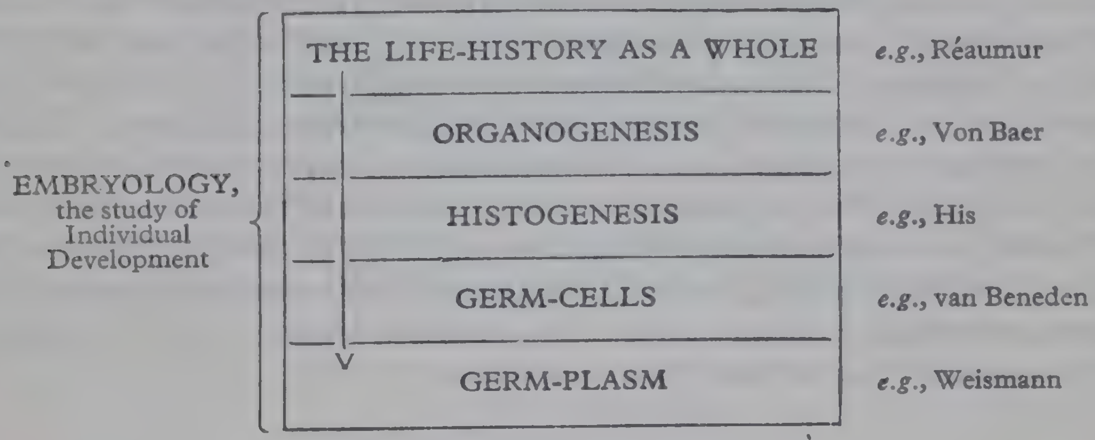
But the second great biological question is : *How does this organism work ?* How does it continue in being, what are its activities, its dynamical aspects ; and the answer to this question is the sub-science of PHYSIOLOGY. And just as with Morphology, so with Physiology, the history has been a gradually more penetrating analysis, from the intact organism, with its creeping, running, swimming, flying and so forth, to the functions of the various organs, such as the beating heart and the filtering kidneys. Thence to the properties of tissues, *e.g.*, the irritability of nerves and the contractility of muscles. But this leads to the everyday life of the component cells that build up tissues in most living beings. Whence there is but another step to the chemical and physical changes and their regulation within the protoplasm which Huxley called " the physical basis of life." So again the same logical and factual scheme appears :—

PHYSIOLOGY, the study of Function	THE ORGANISM AS A WHOLE	*e.g.*, Old Naturalists
	FUNCTIONS OF ORGANS	*e.g.*, Harvey
	PROPERTIES OF TISSUES	*e.g.*, Bichat
	LIFE OF CELLS	*e.g.*, Virchow
	VITAL CHANGES IN PROTOPLASM	*e.g.*, Claude Bernard

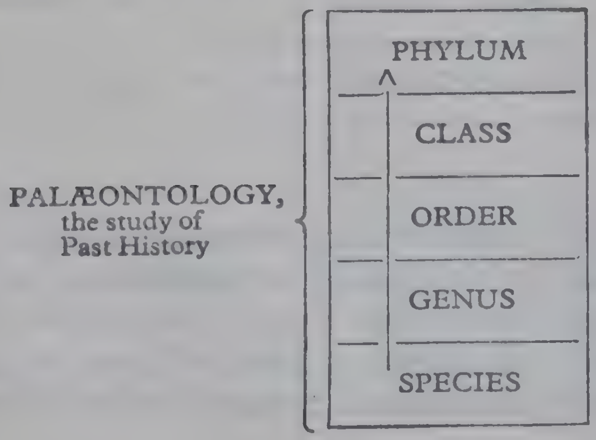
But there is a " higher physiology," which emerges when we envisage organisms, especially animals, in the plural, as members of a group or race, an association or community. This is the old-fashioned Natural History, which is becoming the precise sub-science of ECOLOGY, the study of habits and habitats, of inter-relations and linkages, at the various levels of pair, family, kindred, community, fauna—all considered from the physiological point of view. Thus the scheme stands :—



The third biological question is : *Whence ?* In what form did this organism begin, and through what stages did it come to be as it is ? When this question is answered for the individual, the result is the sub-science of EMBRYOLOGY—the science of development or individual Becoming. And here again there must be a sequence of steps—from the more superficial to the deeper aspects :—



But the same question *Whence ?* may be asked for the group or race to which the organism belongs ; and the answer, dug out of the fossil-bearing rocks, is the sub-science of PALÆONTOLOGY, the study of pedigrees or racial Becoming. So the scheme reappears :—



The fourth biological question is the most difficult : *How have the forms and functions of life come to be as they are ?* The question " Whence ? " is answered for the individual by Embryology and for the race by Palæontology—not that any answer is within sight of completeness, but the new question is into the " How " of the " Thence," a question into causes, into the factors operative in the development of the individual (Ontogeny) and in the evolution of the race (Phylogeny). This is what Huxley called ÆTIOLOGY, with its two sub-sciences of Evolution-Theory and Physiological Embryology or Development-Theory.

This mapping-out of Biology may seem to the newcomer very academic, but it is essential to an understanding of the aims and methods of the science, and it gives a background against which particular advances can be seen in perspective. If we lift up the rectangles and piece them together we get Geddes's map of Biology (slightly modified) in which we see more and more the longer we study it.

BIOLOGY

GROUP	PALÆONTOLOGY	TAXONOMY	ECOLOGY	EVOLUTION THEORY	Phylogeny of Race
INDIVIDUAL	EMBRYOLOGY	MORPHOLOGY	PHYSIOLOGY	DEVELOPMENT THEORY	Ontogeny of Individual
	STATIC		DYNAMIC		

GREAT EVENTS IN BIOLOGY

(*A slow reading of this historical section will reward the student, but it may be postponed to the end of the Article.*)

The foundation-stones of Biology were laid by Aristotle (384–322 B.C.), a great initiator, anatomist and embryologist, as well as naturalist-observer. But centuries passed before he found an outstanding successor —namely, Galen (A.D. 131–201)—who returned to actual dissection and nitiated experimental physiology. Then came the ages of preoccupation nd tradition, and (apart from a few irrepressible observers) it was not till he sixteenth century that the fetters were broken. The Belgian anatomist, Vesalius (1514–1564), insisted effectively on an independent scrutiny of acts, and an even greater initiator of later date was William Harvey 1578–1657), who demonstrated what some precursors had hinted at—he circulation of the blood. This was a great discovery in itself, but it was also epoch-making as the first proof that some activities of the living body may be in some measure described in terms of mechanics. For Harvey showed how it was that the blood was forced to go round the body. Harvey was still a believer in the old theory of spontaneous generation (that living creatures may arise from non-living matter), but he had a remarkable prevision of the fact that " all animals are in some sort produced from eggs," and of the fundamental idea that in the apparently simple germ from which an animal, such as a chick, is developed, " no part of the future organism exists *de facto*, but all parts inhere *in potentia*." Thus he contradicted the long-lived notion that a preformed miniature of the future animal lay within the germ-cell, only requiring to be unfolded.

Among the early foundation-layers we are inclined to include the Italian, Redi (1626–1698), for the clear-cut experiments by which he disproved alleged cases of spontaneous generation—a tenacious heresy to which the convincing experiments of Pasteur and Tyndall hardly sufficed to give a death-blow. Also fundamental was the work of the early microscopists—some would trace the compound microscope back to Galileo about 1610—for besides disclosing a new world of minutiose life and a new intricacy everywhere, they showed how the invisible illumined what had previously been obscure. Thus, while Harvey proved the circulation of the blood, he did not know of the invisibly delicate capillaries which connect the ends of the arteries with the beginnings of the veins, and make the whole *a closed system* of vessels. These capillaries were demonstrated in the frog's lung by Malpighi (1628–1694), born in the year of the publication of Harvey's *De Motu Cordis et Sanguinis*. Similarly, the everyday life of insects was not intelligible until some of the early microscopists, like Swammerdam (1637–1680), showed how the respiratory tubes or tracheæ divide into microscopically minute branches which carry air to every recess of the intricate body. Thus the invisible makes the visible intelligible. Great honour is also due to Leeuwenhoek (1632–1723), an investigator of splendid achievement, who discovered not merely Infusorians but Bacteria and spermatozoa.

At this stage we must recall, from the preceding section, the useful general idea that the history of Biology shows a more and more penetrating analysis, from organisms to organs, from organs to tissues, from tissues to cells, from cells to protoplasm. With this as general clue, we shall now very briefly recount some of the events that seem to us most momentous, always admitting that in this matter there is room for considerable difference of opinion.

Linnæus (1707–1778), often called " the Father of Botany," laid the foundations of Classification (Taxonomy) and struck a new note in including Plants and Animals under the common title " Organisata." What is now a commonplace was a great discovery in its day, that Plants and Animals are equally alive, though on very different lines.

Cuvier (1769–1832) laid the foundations of Comparative Anatomy, and expounded the idea of the correlation of organs in the body, showing, for instance, that all mammals with hollow horns have cloven hoofs. He also began to do justice to fossils as relics of extinct types.

Goethe, an early evolutionist, and thus siding against the conservative

Cuvier and with Geoffroy Saint-Hilaire and Lamarck, invented the term "morphology," and illustrated with vivid clearness the concept of homology or deep-seated resemblance in structure and development. He was one of the first to discern the real nature of the flower, which he recognised as four whorls of much transformed leaves. He had a vivid interpretative insight into the unity of plan underlying great series of organic structures.

Lavoisier (1743–1794), the main founder of modern chemistry, is ever memorable in the history of Biology for his recognition of the oxidation-process that all living involves. He saw that the burning candle and the panting mouse were both illustrating combustion.

After Stephen Hales (1677–1761) initiated vegetable physiology and Priestley (1733–1804) discovered, or re-discovered, oxygen, and after hardly less important steps taken by Ingenhousz (1730–1799) and De Saussure (1767–1845), there began to be some understanding, still incomplete, of the process of photosynthesis—the most important vital process in the world—by which green plants use part of the energy of sunshine to build up nutritive carbon-compounds from carbon dioxide and water.

Liebig (1803–1873) was pre-eminent in demonstrating the circulation of matter, a fact of the deepest importance in Biology. He showed in a luminous way how the elements, *e.g.* carbon, nitrogen, sulphur, iron, pass from one chemical linkage to another in endless cycles.

In 1838–1839 Schwann and Schleiden formulated the Cell-Theory, Goodsir and Virchow being contemporary discoverers, and Lamarck a notable anticipator. The Cell-Theory includes three propositions: (1) all organisms have a cellular structure, being either single-celled (the Protozoa or simplest animals and the Protophytes or simplest plants) or multi-cellular (the Metazoa and the Metaphytes); (2) every multicellular organism, reproduced in the ordinary way, begins as a fertilised egg-cell, which develops into an embryo and young creature by continued division and differentiation of cells; (3) the life of the multi-cellular organism is the regulated and unified sum of the lives of the component cells. This Cell-Doctrine, as it should be called, is one of the foundation-stones of Biology.

The Russo-German investigator, Karl Ernst von Baer (1792–1876), was the founder of Comparative Embryology, and one of the first to discern that individual development (Ontogeny) is in some measure a recapitulation of racial evolution (Phylogeny). Development, he said, proceeds from the generalised to the more specialised; the developing heart or brain of a mammal goes through stages which are permanent in less highly evolved backboned animals.

A very important step associated with the names of Dujardin, Von Mohl, Max Schultze and Cohn, about the middle of the nineteenth century, was the extension of scrutiny beyond the cell to its contents of living matter or protoplasm. It is difficult for us to realise that it was only about that time that biologists discerned that all organisms have protoplasm in common, specific though it is for each particular type. All living creatures are built up of similar material, and yet it has an individuality for each definite kind.

Another milestone was Wöhler's building up or chemical synthesis of urea in 1828, urea being the very characteristic waste-product in the urine of mammals. This was the breaking down of the blockading wall between what goes on in non-living Nature and what goes on in the living body. It was also the initial step in that remarkable series of syntheses by which the chemist—almost creative—has artifically built up not only sugars and alcohols, but amino-acids which have been called the building-stones of life, besides such precious substances as thyroxin (the hormone of the thyroid gland) and adrenalin (the hormone of the supra-renal bodies). Hormones are chemical messengers of great potency which are produced in the *ductless* glands, such as the thyroid and the supra-renal, and are distributed by the blood throughout the body. They affect the activity of certain parts in a very remarkable way, sometimes accelerating, sometimes putting on a brake. They are indispensable to health, for they regulate the activities of the body.

Much physiological progress was due to Claude Bernard (1813–1878), who established experimental physiology on a firm foundation ; discovered that one of the great functions of the liver is to make glycogen o animal starch, an important nutritive reserve ; and distinguished the up-building (anabolism) and the down-breaking (katabolism) which alternate with one another in the chemical routine (or metabolism) of the body. O fundamental importance was his famous book, *Phénomènes de la Vi communs aux Animaux et aux Végétaux* (1878), in which he showed th deep resemblances between Plants and Animals in their main vital processes, except as regards the photosynthesis or up-building of carbon-compounds, which goes on in all green leaves. Later on this rapprochement of Plants and Animals was extended to a recognition of the dee similarities, in spite of superficial differences, in the reproductive processes in the two sub-kingdoms. Very noteworthy was the clearing u (by Steenstrup and others) of the alternation of generations in variou classes of animals, such as zoophytes, and the masterly work of Hofmeister, who traced the same alternation of generations from Liverwort and Mosses to Ferns and Lycopods, and thence to Flowering Plant where it is so well concealed. This is a long story, but it may be enoug here to notice that an ordinary asexual Fern-plant produces spores whic develop into minute sexual prothalli. From fertilised egg-cells produce by the prothallus, and fertilised by sperm-cells, there develop the familiar spore-producing fern-plants.

Much progress was due to August Weismann (1834–1914) who though out the first coherent theory of heredity. By his demonstration and understanding of “ the continuity of the germ-plasm,” he explained, for th first time clearly, how like tends to beget like ; he focussed the idea tha new departures or variations are due to changes in the germ-cells ; h anticipated the modern theory of hereditary “ factors ” or “ determinants,” now called “ genes ” ; and much has followed from his damaging if not destructive, criticism of the evidence adduced in support of th Lamarckian theory of the transmissibility of individually acquired somati modifications. The continuity of the germ-plasm means that when a fertilised egg is developing into an embryo, part of the germinal material i not used in body-making, but remains apart to form the beginning of th reproductive organs of the offspring.

To Pasteur may be referred the modern recognition of the manifold rôle of Bacteria and of the fundamental part that enzymes or ferments play in vital processes. For there can be no approach to an understanding of the activities of living creatures unless we recognise the marvellous power that ferments have of accelerating chemical changes. To Bayliss and Starling, about 1904, is due the demonstration of the rôle of "hormones," to which we referred above. They are the almost magically potent secretions of the ductless glands, and they serve as regulative agents in the healthy functioning of the body. Diseases like diabetes and cretinism are due to disturbances in the working of the hormone-making glands.

The great pre-Darwinian evolutionists were Erasmus Darwin, Buffon and Lamarck—the last the greatest, especially perhaps in his recognition of Psycho-biosis or the mental aspect of life. For Lamarck had a vivid appreciation of the share that an insurgent, wilful, struggling organism, full of need or "besoin," may have in its own evolution. To Charles Darwin and Alfred Russel Wallace the debt of Biology is great and manifold; but their theory of Natural Selection stands out prominently. That is to say, they discerned the scope and subtlety of the unconscious sifting that is involved in the struggle for existence.

Epoch-making beyond doubt, though unrecognised in his lifetime, was Mendel, who discovered the mode of inheritance which bears his name. Along with Weismann—who was chiefly concerned with germ-cells—and Francis Galton—who applied statistical methods—Mendel helped to lay the foundation-stones of the sub-science of Genetics, which he based on experiment.

Very influential has been the discovery of the dual nature of lichens by De Bary (1866) and Schwendener (1868), who showed that these plants express an intimate partnership of a particular Fungus and a particular Alga. This was an important discovery in itself, but it also led on to the recognition of many other forms of symbiosis, as the mutually beneficial nternal partnership is called, and of other linkages as well, such as the ineresting external partnership known as commensalism, which is well llustrated by the "mutualism" between certain hermit-crabs and certain ea-anemones. The idea of inter-relations or linkages in an ever-complexiying web of life was in the mind of old-fashioned naturalists like Gilbert White, and it was central to Charles Darwin's thinking.

Among other foundation-stones we may mention the intimate analysis of ordinary (mitotic) cell-division, remarkable for the meticulous accuracy with which half of each structure in the parent-cell passes into each daughter-cell; the discovery of the peculiar mode of cell-division known s meiotic, which occurs at the maturation of egg-cells and sperm-cells nd is remarkable because the *number* of the nuclear rods or chromosomes s halved for each daughter-cell; the recognition of these chromosomes s the specialised bearers of the initiatives or "genes" of the hereditary haracters; and the deepening of knowledge in regard to what happens when a sperm-cell fertilises an egg-cell.

Thomas Graham's study (1861) of osmosis and his disclosure of the roperties of matter in a colloidal state has proved of fundamental imporance in modern physiology; and we must single out Hardy's proof, about 899, that active protoplasm has no microscopically visible framework, but is a fluid system, with not less than 70 per cent. of water, in which are suspended innumerable ultra-microscopic mobile particles and unmixing droplets, presenting a large sum-total of surface on which chemical and physical changes may take place.

Mention should also be made of the introduction of a new organon in biological investigation—namely, statistical methods or biometrics. This has yielded valuable results in the skilful hands of Galton and Pearson, Weldon and Pearl, and has a promiseful future before it.

Also fundamental, we may almost say essential, is the critical study, by investigators like Lloyd Morgan, of Animal Behaviour at its many levels, and the recognition of the rôle of " Mind " as a *vera causa* in Organic Evolution and in the unending Drama of Life from day to day.

SCIENCE IN MAN'S SERVICE

Since Man came to his own as a wide-awake intelligence, he has been familiar with the idea of utilising expert knowledge as a guide in facing practical difficulties. Even in prehistoric days there must have been expert lore to which appeal was made. Men took counsel with the elders of the tribe, the magicians, the priests, and, later on, with the wise men—who correspond to our scientists. In everyday routine it was enough to follow tradition and the dictates of common sense; but in face of crises there was an appeal to experts or supposed experts. This was the beginning of what is increasingly characteristic of modern times—the habit of using science as a guide in practical affairs. As a practical policy this habit is in greater part modern, though the germ of it is as old as mankind. Thus it seemed a new idea that Herbert Spencer promulgated in his epigram : Science is for Life, not Life for Science.

Man, like the rest of creation, often illustrates " the principle of least action," as the Earth in its orbit ; that is to say, he prefers to avoid taking trouble or thought, he trusts to tradition and to common sense as far as they will take him. For science is difficult to understand, and consulting the wise man or scientific expert usually involves a fee. Thus men built beautiful boats and bridges by rule of thumb, and the old-fashioned farmers and breeders succeeded wonderfully well without any agricultural chemistry or Mendelian genetics. " Wonderfully well," we say, yet often very wastefully, often very slowly, and sometimes not at all—being hindered or baulked by lack of understanding. Yet for many centuries tradition and common sense worked not so badly, especially in regard to the easier practical problems.

Gradually, however, with increase of population and the quickening of the pace of life, it became necessary to get more coal and iron out of the ground, more wheat from the fields, more fish from the sea, besides quickening transport with locomotives and steamships, and shortening distances with great bridges, tunnels and the like. We need not elaborate for it is well known that in one field after another novel difficulties had to be faced, and an appeal to science became more and more imperative Meanwhile, after the Renaissance—say from the classic works of Copernicus and Vesalius in 1543—the sciences themselves had been growing, as the outcome of man's irresistible inquisitiveness and desire to discover causes ; and although their main *motif* was always towards fuller understanding, they became increasingly able and willing to assist, as Bacon put it, in the relief of man's estate. Thus and thus there arose what are somewhat unhappily called the Applied Sciences, such as Agriculture, Engineering, Metallurgy, Navigation and so on through a long and lengthening list. They consist of applications of Pure Science to particular practical problems or crafts, and it is only in so far as they conform to this description that they can be called scientific. For they often include masses of information which do not rise high above the old empirical lore in which all science began. Naturally enough, the sciences that were first appealed to were those that had made most progress—the exact sciences of Physics, Chemistry, Astronomy, Mechanics and the like. The appeal to Biology as a science is quite modern, practically post-Darwinian.

To this last statement exception may be taken on the ground that Medicine has always been appealed to, and Medicine goes back to Hippocrates (born about 470 B.C.), who was of high rank as a scientific thinker. But the apparent exception is not a very real one, for the old-established custom of sending for the physician when life was menaced was for many centuries rather an appeal to an art or to an honourable craft than to science as such. No doubt the end of the Dark Ages saw, in the work of pioneers like Vesalius (1514–1564), the beginning of the laying or relaying of the scientific foundations of medicine, but the idea of medicine as a biological science is in the main post-Darwinian. It may indeed be dated from Pasteur with his germ-theory of disease, or from Virchow with his "Cellular Pathology." We do not wish to over-labour the distinction, but the metamorphosis of the Art of Medicine, from a craft to a science, is distinctively modern, and the long-standing habit of sending for the physician is not much of an exception to our conclusion that man's appeal to Biology is a quite recent development.

Discovery and Invention

It has been said that apart from prophets, priests and kings no single man ever changed the face of civilisation so much as Newton ; and in any case it is agreed by all that he was one of the great initiators, giving man keys which opened practical as well as theoretical doors. His work is a good illustration of the important fact which the history of science proves, that most of the vitally important practical inventions are based on recondite researches in Pure Science. If we think of such devices as telegraphy, telephoning, broadcasting, the use of rays in medicine and surgery, the serum treatment of disease, we find that they are based on very theoretical researches and discoveries. It we use Bacon's memorable phrases for the twofold function of science as light-bringing (luciferous) and fruit-bearing (fructiferous), we may safely say that the first conditions he second, theoretical discovery preceding practical invention. At the same time we are bound to recognise that some urgent practical need or some wave of emotion has often given point and purpose to scientific reearch. Thus although Lister was from his inborn scientific curiosity nterested in physiology and in microbes, it was, he tells us, the tragedy of the high mortality in the hospital wards that urged him towards his antiseptic methods. Similarly with Pasteur, whose early researches on tartrates were as theoretical as his later ones were practical.

The historical point is that the successes of science in solving practical problems gave the public a respect for science as such ; and this accounts for the early recognition of the value of chemistry and physics and mechanics, and the tardy recognition of biology and psychology. Is there a demand for a new drug or dye, a new fuel or explosive, the citizen has now learned to look to chemistry ; but the time has hardly come when the problems of population or of human inheritance immediately suggest an appeal to biology. Is there a question of a difficult bridge to be built or a more reliable airship, it would be regarded as extreme folly to experiment without the scientific expert ; but the citizen has hardly realised that it is almost as absurd to make educational experiments apart from the advice of the psychologist, or environmental and occupational experiments without consulting the biologist. It comes as a surprise as yet to hear a prophetic appreciation of what Biology may mean for human life, as when Sir Walter Morley Fletcher recently startled the public by saying in a National Broadcast, that " we can find safety and progress only in proportion as we bring into our methods of statecraft the guidance of biological truth."

The Appeal to Biology very Modern

To understand the position to-day we must recognise, as we have said, the greater prestige of chemical and physical science as compared with Biology. This is the natural outcome of : (1) The more advanced state of the exact sciences, and (2) the many impressive triumphs which have rewarded the application of these sciences to the service of man. But since Darwin's day the science of Biology has become more mature and more exact, and it also has some triumphs of practical application ; *e.g.*, in connexion with Mendelian breeding, the life-history of formidable parasites, the rôle of vitamins in diet and of hormones in health. Thus the eyes of many citizens of the world are now beginning to think of Biology as a possible light to their feet and lamp to their path. This appeal will become more insistent in proportion as ordinary men and women turn from traditional and vaguely instinctive promptings to face the facts and to demand scientific guidance—biological as well as physical.

BIOLOGY AND HUMAN LIFE

Assuming, alas ! with considerable warrant, a critic who smiles at the idea of Biology having anything to do with civilisation, let us state the case for our science. How are we to classify the services that Biology renders to Man ? First, there are the direct contributions which alleviate the struggle for existence by increasing the food supply and improving the more elementary amenities of life. Second, there is the assistance that Biology offers : (*a*) in the conquest of disease ; and (*b*) in the quest for positive health.

Third, there is the biological counsel which is already available in regard to certain perennial problems of human life, such as those centred in sex. Fourth, there is the genetic basis of eugenics. Fifth, there is the cultural value of biological study. Sixth, there is the ethical value of Biology as a guide in conduct. And seventh, there are the contributions that Biology offers to our synoptic (philosophical and religious) outlook on the world as a whole.

I. Biology and the Struggle for Existence

Though man does not live by bread alone, food is his first need ; and Biology can certainly help him to make two blades of grass grow where only one grew before. And all flesh, however carnivorous, is in the long run grass. Biologists have discovered the secret of the success of leguminous plants, that they have partner-bacteria in their root-tubercles which are somehow able to capture the free nitrogen in the soil-air or soil-water. These friendly symbiotic microbes add to the plant's nutritive reserves of nitrogenous carbon-compounds, and if the crop is systematically dug in or ploughed in, then poor soil will become good soil, and there will be more food for man and beast. In several ways Biology is instructing the agriculturist how to reclaim waste places, and if success rewards the promising experiments now begun on transforming peat-bogs into crop-growing fields it will be a great day for many a crofter. If the population of the globe goes on increasing at its present rate, with an absolute addition of 12-14 millions every year, a terrible struggle for food is in prospect. If Biology can increase the food supply—a power which no one doubts—there is a greater chance of avoiding a *débâcle* before the birth-rate is reduced to meet the conditions of existence. Thus at the very outset we see how Biology may contribute to the welfare of civilisation.

What an advance there is from the wild wheat still growing on Mount Hermon to a first-class modern wheat like Marquis, an advance not only n number of seeds, but in their nutritive value. Especially of recent years there has been a remarkable patience of sifting on the part of experimental biologists devoted to wheat and, if we are on the outlook for significance to mankind, we must remember that Marquis Wheat was certainly one of the factors that won the Great War.

The methods of the Mendelians make it possible to graft on to a proific wheat various other good qualities, such as early ripening or a texture that grinds well and yields attractive flour. Some ten years ago Professor Punnett, one of the leading geneticists of Great Britain, said in a ecture :

> " Take wheat alone. Biffen's work has already added hundreds of thousands of pounds yearly to the wealth of this country. Howard in India has produced a new wheat which is now spreading over the Central Provinces and is expected shortly to increase the annual value of the crop in that area alone by £7,000,000. The experiment station in Ohio is supplying the farmers of that State with a wheat that produces on an average an increase of two bushels to the acre on those previously grown. With two million acres under this cereal the gain is obviously considerable."

Since this was said the improvement of wheats has continued, and the magnitude of the biological advance is not fundamentally affected by the complex social and economic conditions that have robbed wheat-growers in Britain, for instance, of much of their reward, and have made the loaf dearer not cheaper. We are not here called on to enter these deep waters.

What botanical biology has done for wheat—one instance out of many—zoological biology has done for many animals. Breeds of poultry have been established in which the individual hen may lay two hundred or more eggs in the year. In a limited freshwater area it is possible to multiply the trout, even by the rough-and-ready method of pitching cartloads of bracken into the water. As we have said elsewhere : " Bacteria working on the bracken thrive and multiply, they afford food for infusorians, and they also liberate the stimulants of vegetative growth. The replenished hosts of infusorians and Algæ are devoured by minute Crustaceans, which afford food for freshwater fishes. Here we have a hint of a possible correlation between bracken and breakfast. And while the sceptic and patriot may refuse to cast his bread on the waters, who would not cast bracken which is conquering all too easily in the struggle for existence with much better plants ? " There would be more chance of checking the deplorable ruin of pasture by bracken—a ruin for which a cure is on the horizon even as we write—if some use could be found for the fern, and what could be better than turning it into trout and thus, eventually, into man ! Whether we think of wheat or of trout we see a scientific echo of the miracle of multiplying loaves and fishes ; and there is no irreverence in recognising this.

Our thesis is that Biological Science helps to spread man's table ; and there are many ways of doing this besides directly increasing the supply of edible plants and animals. Under expert control there may be great increase of a country's wealth by the naturalisation of useful plants, like fruit-trees at the Cape, and useful animals, like sheep in New Zealand. Great things have been done in the way of saving crops and herds from formidable parasites and from less insidious enemies. An almost ideal utilisation of animals is illustrated by bee-keeping. The honeymakers have not been much deteriorated by their masters, however they may have suffered from their own servile state. They do not require much artificial nurture, and would probably be better with less. They produce a very delightful food at a minimum cost to man. There is no reason save slackness why a country like Britain should not flow with honey. And if the critic naturally reminds us of the " Isle of Wight " disease which has ruined so many apiaries from Ventnor to Cape Wrath, the reply is that the parasitic mite associated with this malady has been discovered, and that ways are being devised for circumventing its ravages. In a score of similar cases the dramatic sequence of events has been the same : a disease crops up with disastrous results ; the cause of the disease is discovered by the biologist ; and then there follows either cure or prevention. Very dramatic and not less effective is the prevention of some of the scale-insect diseases of imported fruit-trees, notably the oranges and lemons of California, by also importing the natural insect-enemies of the scale. This also is spreading man's table.

We do not wish to dwell longer on the contributions made by Biology to the bread-and-butter problem, though these are far-reaching and will increase in importance if the world's population goes on growing at its present rapid rate. Before the appearance of notices saying " Standing Room Only " there is likely to be a struggle for subsistence too terrible to think of, yet it is *possible* that some momentous bio-chemical discovery will alter the whole aspect of the nutritive problem. This might come about, for instance, if there is confirmation and extension of Professor Baly's synthesis of sugar and other carbon-compounds by the action of light on carbon dioxide and water. This is not our present business, yet we must keep in mind the achievements of the almost creative chemists, even to the artificial synthesis of the amino-acids which have been called the building-stones of living matter. Nor should we forget how waterfalls are now used to produce great discharges of electricity which capture some of the free nitrogen of the air, binding it into ammonium nitrite or the like—the basis of " fertilisers " which increase the yield of wheat. So, in a way, science makes bread out of the thin air. This, then, is our first point, that Biology spreads man's table.

II. Biology in Relation to Health and Disease

It was a momentous event in civilisation when Pasteur demonstrated the microbic nature of many diseases. We can hardly realise the change in the entire outlook, not only of medical experts, but of ordinary citizens when it was clearly seen that disease is no mysterious power suddenly emerging out of darkness and clutching man by the throat, but is in many cases due to the invasion of the body by a microbe—a microscopic living creature that can be contended with and often conquered. Discovery of causes was followed by discovery of cures, and then there arose a system of Preventive Medicine which vindicated man's natural love of light, fresh air and cleanliness, and showed in prosaic detail how infection might be in many cases avoided. There followed a recognition that some very important diseases, such as malaria and sleeping sickness, were caused not by Bacteria, which are generally regarded as of the nature of single-celled *plants*, but by Protozoa, that is to say, by intruding microscopic *animals* which destroy or poison the living cells of the body. And as an invaluable contribution of Natural History to Medicine there has arisen a fascinating department of ecology which deals with the carriers of the disease-microbes and of the larger parasites. Thus, as everyone knows, various kinds of mosquitoes carry the various malaria-organisms, and the tsetse flies are the disseminators of sleeping sickness. With a deepening knowledge of the habits of these carriers or disseminators, and of the life-history of the intruders or parasites themselves, there is arising an increasing body of knowledge leading to methods of sure prevention which are even more hopeful than the achievement of cures. With biological science behind him, man is conquering one disease after another.

Hookworm disease, or ankylostomiasis, is the cause of one of the heaviest mundane clouds that have ever rested on the human race, producing in many warm countries the " tropical depression " which travellers, missionaries and employers of labour have often deplored. It is due to several kinds of threadworm (species of Ankylostomum and

Necator) that pass as larvæ through cracks in the skin of bare feet, and burrowing in the body, fix themselves in the wall of the food-canal. They grip firmly by means of hooks beside their mouth and draw blood from the lining membrane. The results are bloodlessness or anæmia, weakness, emaciation, melancholy, lassitude, despair and death. The disease, for so many years a mystery, is now well understood ; the intruding hookworms can be readily expelled from the food-canal by doses of carbon-tetrachloride, and further infection can be prevented by theoretically simple sanitary measures, which keep the soil around the village from being diffusely infected with the young stages of the hookworm. Thanks to medical efforts, especially those of the Rockefeller Institute campaign, the incidence of hookworm disease has been checked over vast areas and has been in some places reduced from 25 to 2 per cent. of the population. With patience and goodwill the heavy cloud will disappear ; our present point is that the preventive measures are based on a deepening of biological knowledge.

Human progress is mainly due to positive ameliorations—physical, organic and social ; but it is no small gain when handicaps are removed, and the heaviest of all handicaps is disease. So let us take another instance of Biology to the rescue. In various warm countries, such as Egypt and Japan, a painful and serious disease known as " bilharziasis " is rife. Every third child born in Cairo becomes infected with bilharziasis and in some places every third adult has the disease, which is due to various species of a very peculiar worm (Schistosomum) in the order of Trematodes, to which the liver-fluke of sheep also belongs. The microscopic larvæ, like transparent forked threads, enter man through cracks or abrasions on the skin, and occasionally on the lips and lining of the mouth. Passing through the body, many of them take up their abode in the bloodvessels of the small intestine and in the region of the kidneys and bladder. This varies with the different species of Schistosomum. They produce minute hard-shelled eggs, each with a lateral or terminal spine (according to the species), and the pressure of the multitudinous sharp spines on the walls of the bloodvessels causes great pain. The minute eggs are passed out from the kidneys or the food canal, according to the species ; and, unless precautions are taken, they may readily find their way into water-pools. There they hatch into microscopic larvæ, which enter various species of water-snail such as Planorbis and Isidora, and there continue their development somewhat in the same way as the young stages of the liver-fluke develop inside the little water-snail, Limnæus. From the water-snail there emerge other more advanced larval stages, minute, threadlike and free-swimming, called cercariæ, and these bore into the skin of children who paddle or bathe in the water, or into the hands of washerwomen, gardeners and the like. Apart from man, their host is some aquatic mammal such as a water-vole. The life-history which we have just outlined was elucidated by Major Leiper during the War, when bilharziasis often occurred among our soldiers in Egypt, and his biological investigation threw immediate light on prevention. Contamination of water-pools may be prevented ; children may be forbidden to bathe there ; water-snails may be collected ; snail-eating birds may be encouraged ; the aquatic plants that the snails browse on may be destroyed ; the larvæ on watercress and the like are killed by dissolving tabloids of sulphate of soda, and they die in thirty-six hours in water that is kept quite still. In these and other ways Biology has shown man how to conquer a serious disease, a handicap to progress.

III. Biology and Life's Difficulties

There are many indications to-day that we are at the beginning of a new era—the era of biological control, when for the first time on a large scale nankind is turning to the life-sciences (in addition to Medicine), and saying : " Show us what you can do for us in the way of betterment." Sporadically in recent years Biology has been consulted by physicians, educationists, practical men, and even statesmen ; there are signs, we think, that it is soon going to be appealed to more generally by educated iumanity, seeking life more abundantly. Let us illustrate our meaning.

In civilised society—and that is no modern affair—there is a sorry requency of sex-pathology, taking many forms. What should be the inest expression of our life is too often ugly and besmirched. Often what hould be highest happiness becomes an obsession or repression, the ource of unhappiness, it may even be of disaster—physical, mental and noral. In place of the old tribal instructions and initiations, though these nad their morbidities, too, there has been for centuries a taboo of the ubject except in salacious form, and adolescence is allowed to steal in on ife like a thief in the night.

But what can Biology do to help ? It can present the normal facts of sex n impersonal and scientific form. It can give to much that is puzzling an ntelligible interpretation ; for instance, by explaining the rôle of the sex iormones. These hormones or internal secretions, as we have already xplained, are potent chemical messengers which are produced in ductless landular tissue and are distributed by the blood throughout the body, xciting, or sometimes hindering, activity in particular structures. The ex-hormones from ductless glandular tissue associated with the reproluctive organs are produced very markedly at adolescence, and evoke hanges in body and mind which were mysteries till the rôle of these hemical messengers was discovered.[1] Biology can also trace with great dvantage the evolution of sex through the animal kingdom and show ow the path of progressive evolution has been one on which a primarily hysiological urge becomes an æsthetic attraction, and rises from fondness y psychical refinement to lasting love. It can also show how self-indulence is apt to lead to tyrannous habits and even to nervous deteriorations ; nd so on and so forth.

This is but a single illustration, for in many directions Biology is now nature enough to give man definite counsel, not to replace, but to supplenent the older controls of an ethical, traditional and religious character. Biology can advise as to habit-forming, diet, stimulants, improved nvironment, sleep, play, population and the culture of existence in eneral. When its advice is widely asked and taken a new era will have awned.

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[1] For a fuller treatment of this subject, see the Article on *Sex*, p. 283.

IV. *The Cultural Value of Biology*

The utilitarian value of Biology is being increasingly recognised, but can the same be said for its educative or cultural rôle ? As a recreation the old-fashioned Natural History, now rising into Ecology (the science of habits, habitats and inter-relations), may perhaps be holding its own ; but there are at present few enthusiasts for the educational value of the biological sciences. This is partly because these do not afford that resoluteness of discipline to be found in the study of the exacter sciences, like mathematics, chemistry and physics. But another reason, we fear, is that we live in a dominatingly mechanical age, and “ as is the world on the banks, so is the mind of man.” The fact is that man needs biological culture more than ever before.

(*a*) To the biological sciences we owe many mental pictures that are treasures. The Natural History and Botanical picture-gallery is full of masterpieces, such as the world of the great oceanic abysses, or the woods of the Yosemite valley.

(*b*) The study of Animate Nature is an æsthetic education. Everywhere there is beauty—of form, of colouring, or of movement ; easy beauty of bird and tree, difficult beauty of serpent and sea-wrack ; conspicuous beauty like the peacock's tail, hidden beauty such as the internal zoned architecture of a sea-urchin's spine. And while science is in itself quite unemotional, it feeds the æsthetic sense, and the more we know of the biological aspect of withering leaves, the more we enjoy the autumnal woods.

(*c*) The biological sciences open our eyes to the Drama of Life, and excite an ever-increasing interest in things that angels might desire to look into—life-histories, linkages, endeavours, subtleties, comedies, tragedies, anticipations. Animate Nature is an inexhaustible well of surprises, which make for the enrichment and enhancement of man's life It is not that they are curiosities of Natural History, quaint pieces of information ; it is rather that they give us glimpses into the heart of things They suggest Walt Whitman's exclamation : “ Prais'd be the fathomless universe, for life and joy, for objects and knowledge curious.”

(*d*) There is an incalculable cultural value in the great facts and ideas of Biology—the ascent of life, the pulse of evolution, the web of inter-relations, the ceaseless circulation of matter, the development of the embryo, the trajectory of each life-history, the long inclined plane of animal behaviour, rising to remarkable freedom of mind in man.

(*e*) As a fifth contribution to Culture may be ranked the array of brain-stretching problems which biological study provides. It is not to be compared with mathematics for intellectual gymnastics, yet Animate Nature is a “ Euclid ” by itself, tending to develop sound judgment Who can tell us why a cell divides into two, what the fertilisation of the egg-cell really means, how embryonic differentiation comes about, or the true inwardness of sex ? Biology bristles with unsolved problems ; the realm of organisms is full of marks of interrogation.

(*f*) Finally, it must be recognised that sojourning with living creatures in Nature brings home to us the deep impressions of growing, multiplying and developing, of varying, inheriting and sifting. These form indispensable parts of a well-educated man's mental furnishing, and they cannot be replaced by anything else. The fact is that life-lore is essential if our life is not to be impoverished. No doubt many able-minded men and women have got on well without knowing any Biology, but how much more they might have been with it!

V. Biology as a Foundation for Eugenics

Those who cherish ambitions for mankind are unanimous in including healthfulness of race—healthfulness in the widest sense, meaning clear-headedness and goodwill as well as sound physique. The ideal means much more than a reduction of disease, though that always counts for much; it implies positive health, expressing itself in vigour, resisting power, initiative and joy. No one can look around to-day and remain complacent: so many are diseased in body and mind; so many are victims of their appetites; so many live at a low level of healthfulness, with no more than sub-health; and so many show little trace of beauty or of happiness. The endeavours to raise the standard of racial fitness in our civilised communities are called eugenic, in opposition to dysgenic tendencies which make towards the deterioration of the human breed. Our present point is that the foundation of sound eugenics must be sound Biology.

It is not suggested that all man's troubles are due to causes which more Biology would remedy, for some are in part due to evils inherent in the social system that enmeshes us; others are due to deficiencies in magination, kin-sympathy, and goodwill; others are due to our liking for ower pleasures and for lines of least action; and others again to our mis-education, often including a dismal ignorance of the history of our race. It would be a fallacious "biologism," akin to a fallacious "materialism," o think that applied genetics alone will save us in our sea of troubles. There must be eupsychics, and much more, as well as eugenics.

Here at once we see the eugenic value of Biology, since the biologist is lways seeing the three sides of his prism:—Organism, Function nd Environment; the Living Being, its Doings, and its Surroundings. These obviously correspond to the three chief concepts or co-ordinates of he sociologist: Folk, Work and Place—Le Play's *Famille, Travail, Lieu.* But, even more than the sociologist, the biologist is habituated to considering every problem in these three indissoluble aspects, and is therefore aved from the fallacy of thinking that secure progress can be made by working along one line only. There must be Eutopias and Eutechnics if Eugenics is to have much chance.

Similarly, the biologist, more than any other investigator, is familiar with the idea of the Unity of the Organism, not merely as an orchestral armony, "many members in one body," but as, in its higher expressions, alternately BODY-mind and MIND-body. Thus the biological eugenist will never forget the necessity of Eupsychics; his ideal is *mens sana in orpore sano.*

One of the oldest ambitions in the world is to have a fine family, and ugenics is the modern scientific expression of this ambition, which has ecome in modern times sadly more difficult of fulfilment. There has been, for too long among too many people, a disregard of the need for persistently selecting towards health, and for avoiding as far as may be a sowing of tares along with wheat. It comes to this, that Biology is needed as a broad foundation for eugenics ; we require not merely a deeper knowledge of heredity, of the influence of environment, of the rôle of nurture in general, but a deeper insight into the subtle ways in which Animate Nature has wrought out its exuberance of evolving life.

VI. Ethical Value of Biology

To envisage the ascent of life is to discover a solemnly long series of experiments with life—a book in which man may find guidance. Not indeed clearer or better guidance than he can find elsewhere, as in the history of his race, yet if he reads aright a light to his feet and a lamp to his path. Thus there is the great ethical lesson of the struggle for existence, that things of value require to be struggled for. It is easy to make too much of the cruder forms of the struggle for existence, of Nature red in tooth and claw with rapine, of the Hobbesian warfare—each for himself and extinction take the hindmost ; but more accurate Biology discloses not only the large proportion of time and energy involved in parental care and mutual aid among kindred, but the great rewards that have gone to those animals that show other-regarding endeavours and what amounts to self-subordination. In the success of birds and mammals we see what has been called " a materialised ethical process " ; for such activities as are illustrated by the long-tailed tit's gathering of 2,379 feathers to quilt its nest, or by the prolonged nurture, protection, and education which the mother-otter gives her cubs, have Survival Value just as much as those which are seen when the golden eagle lifts the grouse, or the tiger launches itself on the young deer. There was genuine insight in giving to the highest class of animals—to which man is affiliated—the name of mammals, so obviously suggestive of mothering.

It is not suggested that animals are ethical agents, for there is no warrant for crediting them with general ideas, but the point is that there has been a long evolution of the incipient virtues, the raw materials of good conduct, such as courage, affection, control and sympathy ; and many animals are morally admirable, along certain lines at least. But besides the *occurrence* of the primary virtues among animals, we must recognise that they have been rewarded in the course of Organic Evolution with survival and with success. There is an evolution of ethics, but there is also an ethics of evolution.

No doubt there are seamy sides in Animate Nature, such as parasitism and lurid warnings, such as may be seen without a microscope in the servile state of ants and bees, and with one, if we inquire into the fatigue-degeneration of the brain of the short-lived worker-bee ; yet on the whole it must be allowed that Animate Nature is condemnatory of the unli lamp and the ungirt loin. There are some difficult cases, but Animate Nature is almost always for health, unless man interferes with the conditions of life, as in domestication and cultivation. It is easy enough for anyone so inclined to travesty our thesis, and to say that the very best to be found in Animate Nature is a pageant of lusty animals ; but that is no

curate. The higher creatures are psycho-biological beings, as we our-
lves are ; and proud man has often much to learn from the courting of
rds. Moreover everyone who has reflected knows that our degree of
ealthfulness from day to day is often a subtle and rigorous criterion of
r morals ; and Animate Nature is almost all for health.

VII. Biology and Philosophy

Our last question is the most difficult : How does Biology affect man's
noptic (philosophical and religious) outlook on the world as a whole ?
here are many uncertainties in biological science, especially as regards
e innermost secret of that kind of activity that we call life ; the correla-
on or regulatedness that makes the organism a " whole " ; the true
wardness of sex, of development and of variability ; and the perennial
oblem of the relation between the mental and the bodily aspects of the
ganism—the psycho-biological and the bio-psychological. But there
e great certainties as well. Thus (*a*) There is general agreement that in
me way or other organisms transcend mechanisms; there is an auton-
ny of Biology. Again (*b*) In some way or other the living creature is
ly intelligible as a historic being ; that is to say, in Clifford's words :—

> " It is the peculiarity of living things not merely that they change under the influence of surrounding circumstances, but that any change that takes place in them is not lost, but retained, and, as it were, built into the organism to serve as the foundation for future actions."

ving implies both individual and racial enregistrations; and these are
rtainties, though it is not easy in either case to explain *how* the engrain-
g is effected.

(*c*) It is also characteristic of organisms that each is affiliated to the
st and normally parental to the future. In other words, living creatures
ve to be thought of as links in a hereditary chain, for heredity is the
lation of genetic continuity between successive generations. Ever
esent is the child of the past and the parent of the future. This is, of
urse, an old idea; but it has become more incisive since Galton and
eismann disclosed the fact of the continuity of the germ-plasm—that
dividuals are, as it were, the deciduous pendants of an undying lineage
germ-cells. The parent organism, especially the mother, is obviously
e producer of the offspring ; yet, as Galton said, it is almost truer to say
at the parent is the trustee of the germ-cells, which will eventually
velop into offspring. As Weismann put it :—

> " In each development, a portion of the specific germ-plasm contained in the parent egg-cell is not used up in the construction of the body of the offspring, but is reserved unchanged for the formation of the germ-cells of the following generation."

a deeper way than even Darwin recognised, there is a hereditary
tinuity of generations. The modern biologist thinks of the organism
a living link between past and future.

(*d*) Another fundamental idea in the modern biological view is tha the organism must always be thought of as functioning in particula surroundings which, in turn, condition it and react upon it for goo and ill. The three sides of the prism of life are, as we have already said Organism, function and environment; but at times we must read then the other way round and give the capital letter to the environment o system of surrounding influences—Environment, function, organism These are the three co-ordinates of Biology, inseparable except in scien tific analysis. Since the everyday functions, say, of irritability and con tractility, nutrition and respiration, are wrapped up with the very ide of organism, which becomes an empty name without its functions, it ma be clearer to use the word "functionings" to denote the organism' actions on its environment. Thus the three sides of the biological prisn are Organisms, Functionings and Environments, corresponding to th sociological co-ordinates: Folk, Work and Place, in terms of whic every sociological fact must be considered. As Professor Patrick Gedde has put it, living is a moving equilibrium between O->f->e and E-> ->o; and similarly for the social life of mankind, Fk->w->pl an PL->w->fk. Or in ratio form: $\frac{O\,f\,e}{E\,f\,o}$ and $\frac{Fk\,w\,pl}{Pl\,w\,fk}$; and the biological rati is, as it were, parallel with the sociological.

But (*e*) the relation of an organism to the past is more than that betwee offspring and parents, descendants and near ancestors: it is a racia relation to an older, usually more generalised, stock. A modern hors has an immediate pedigree, but it is also a descendant of remote ancestor with three or four digits, instead of the single finger or toe which the mod ern type bears on each limb. Just as all our modern breeds of domesti cated pigeon are known to have been derived under man's care fror the wild rock dove, *Columba livia*, so the thousands of wild birds are a traceable to some ancestral extinct bird more than hinted at in the firs avian fossil, Archæopteryx, whose structure proclaims that it, in turr was derived from a stock of extinct reptiles. Every organism is an ant quity with a long pedigree, leading back to simpler or more generalise ancestors, except in cases where evolution has been retrogressive c degenerative, as in the case of parasitic and easy-going types, whos ancestors were *less* simple. Moreover, we must think of organisms as nc merely outcomes of evolution, but as themselves, in many cases, evolvin here and now. Variations are still emerging; selection is still in operation new adaptations and even new species are still arising for better or fc worse. The biologist is always saying to himself, in Hegel's words "Becoming, Being, and Having Been."

There can be no synoptic or philosophical view of the world whic does not include living creatures as part of the picture, and our first poir is that these must be thought of as (*a*) Transcending mechanism; (Enregistering experience; (*c*) Affiliated to their immediate progenitors (*d*) Functioning in particular environments; and (*e*) Evolved fror simpler ancestors and in many cases evolving still.

But while it is of great importance to realise these five characteristi of living organisms, they do not exhaust the richness of reality. A Robert Louis Stevenson said, "Science writes of the world as if wit he cold finger of a starfish ; it is all true, but what is it when compared with the reality of which it discourses ? ”

Living beings are always in flux, always breaking down and always being built up again. Their essential constituents are proteins and other carbon-compounds, always being burned or oxidised, and yet the unities we call organisms have their fit symbol in the burning bush of old, for hey are not consumed for many a day. Throughout the world of life here are similar living stones and mortar—protoplasm, the physical basis of life ; but while this makes the whole of Animate Nature kin, the complementary fact is *specificity*, for each species or definable kind is itself and no other. Each has some particular protein, different even in nearly related species, such as fox and wolf, horse and ass. This individuality or idiosyncrasy is one of the marked differences between living organisms and non-living things. Thus we have a first triad of qualities : persistence amid change, ceaseless down-breaking and up-building of colloidal protoplasm, and specificity of proteins for each particular form of life. Colloidal means that the material in question, whether living or not living, consists of innumerable ultra-microscopic particles or unmixng droplets suspended in a fluid ; and its importance is partly because of the multitudinousness of the minute surfaces, on which physical and chemical changes may take place. A drop of protoplasm may be compared to an archipelago of many islands on whose multitudinous coastines there is great opportunity for fishing and trading !

A second triad of qualities characteristic of living beings may be ummed up in three words—growth, multiplication and development. Everywhere in the world of life we see growth, usually accomplished by he division of cells ; and it differs from the accretion-growth of crystals n being from the inside outwards, and because the material used is in most cases very different from that composing the organism. The grass grows at the expense of air and water and the salts of the soil ; the foal grows at the expense of the grass. But a crystal cannot grow except rom a solution of the same kind of material, or occasionally from a different kind of material that has the same crystalline form.

It is normal for a full-grown organism to multiply, and in most animals his occurs when a definite size, *the limit of growth*, is reached. In ways hat vary from type to type, the plant or animal becomes a parent ; and oon there is a succession of generations. In the non-living world there s no counterpart to multiplication unless we point to a nebula giving ise to a double star, or to a molecule dividing into two molecules, or to radio-active substance giving off helium particles—and these are rather ar-fetched analogies.

Not less familiar, and not less striking when one begins to think about t, is the process of development, wherein a detached portion of the dult, or a liberated germ-cell, proceeds to reproduce an entire organism. Out of the apparent simplicity of the egg-cell there develops the obvious omplexity of a young creature ; from a clear drop on the top of the olk of a hen’s egg there develops a chick. From a fragment of a begonia eaf there develops an entire plant—flower and all. The latent becomes patent, the apparently homogeneous becomes the obviously heterogeneous, the invisible becomes visible. Such is development.

The third triad includes two characteristics to which we have alread referred—the enregistering of the past in the present, in such a wa that the future is affected (Bergson's *durée*), and the power of evolving giving rise to something new under the sun—but also a third feature the power of effective response, of purposive (rising to purposeful behaviour. In animals especially, where mind begins to be emancipate this quality of endeavour stands out clearly ; but all through the worl of life there is purposive agency. Here the symbol of the organism is no the burning bush but the bent bow.

Our point, then, is that living creatures, which must be included in ou philosophical picture of the world, show an integration of qualities. Th first triad includes :—

1. Persistence amid incessant change ;
2. The down-breaking and up-building of colloidal protoplasm ; an
3. Specificity.

The second triad includes :—

4. Growth ;
5. Multiplication ; and
6. Development.

The third triad includes :—

7. Enregistration ;
8. Purposive behaviour ; and
9. Evolvability.

An appreciation of these nine characteristics will certainly save us fro an easy-going or a commonplace view of organisms, yet the total impression is too cold and academic. Let us seek, therefore, to envisage th wonder of life more vividly.

THE WONDER OF LIFE

(I) We are impressed by *the abundance of power* in the universe, fro the movements and internal activities of the heavenly bodies down t the fierce little world within the complex atom, and between thes extremes of the infinitely great and the infinitely little are the powers life—the power of winding up the living clock almost as fast as it ru down, the power of an open-sea fish, whose muscles are more efficie as energy-transformers than are the engines of the *Mauretania*, th power of an eagle in the air, far surpassing any flying machine ; an life's power of multiplying itself so that in a few hours an invisib microbe may become a fatal million. Most of the physical and chemic non-living clocks in our cool corner of the world, such as a fragment radium with its extraordinary output of energy, are running down ; bu every living organism succeeds in winding itself up for days or for years for stretching cycles of years. From hour to hour it ripes and ripes, long postponing the evil day when at length it begins to rot and rot, as Shakespeare put it. A great river rushing down to the sea, carving its bed and driving many mills, is a fine example of power, but the otter in the river is finer, for it commands its course. Life is a stream that seems often to flow uphill ; its power is insurgent. As Goethe said, animals seem very often to be attempting the impossible and achieving it. The waterpider, though belonging to a thoroughly terrestrial stock and breathing dry air, just as we do, has chosen to spin a web in the moorland pool. The migratory birds annihilate distance and know no winter in their year. The bat is a true mammal, yet it has learned to fly. Living creatures are marked by extraordinary insurgence, and that is a characteristic part of the picture.

(II) The fact of multitudinous life, we are urging, has to be included n our synoptic picture of the universe, just as we must take account of he numbers and the immensities of the stars. As Spenser said in *The Faerie Queene* :

> " For much more eathe to tell the starres on hy, albe they endlesse seem in estimation, than to recount the sea's posterity ; so fertile be the floods in generation, so huge their numbers and so numberlesse their nation."

ust as the modern astronomer, becoming philosophical, tells us that he heavens declare themselves as the thought of a Supreme Mind, ranscendently mathematical, so a naturalist, familiar with the multiudinous variety of living creatures, is often given to think of a Supreme Mind, transcendently artistic, and loving life for its own sake. We see he world-floor, the great studio of Animate Nature, strewn with sketches, ach a little masterpiece. So Tennyson turned away from peering into he crowded life of the brook, with the exclamation : " What an imagiation God has ! " In any case one gets the impression of endless esources in the creative evolution of individualities.

Over two thousand years ago Aristotle knew about five hundred different kinds of animals, and now the list of the named and known, still ar from complete, includes twenty-five thousand Vertebrates, and a quarter of a million (some zoologists estimate twice as many) Invertrates.

What prodigality of unique species, for each is itself and no other. As St. Paul said :

> " All flesh is not the same flesh, but there is one kind of flesh of men, another flesh of beasts, another of fishes and another of birds."

One can often identify a bird from a single feather that it drops from its wings ; one can often tell a fish from a few scales. Everywhere there is *pecificity.*

(III) Another feature is *intricacy*, for everyone knows that he is fearully and wonderfully made. Our body is built up of millions, billions, rillions of cells or unit corpuscles of living matter. The average man has twenty-five billions of oxygen-capturing red blood corpuscles, which if spread out would occupy a surface of 3,300 square yards. Even more significant is the fact that he has in the cerebral cortex of his brain, the home of the higher intellectual activities, over nine thousand millions of nerve-cells, that is to say, more than five times the present population of the globe—surely more than the said brain of the average man as yet makes use of ! And our impression of intricacy grows when we realise that these neurons are connected to one another by branching processes or dendrites which make multitudinous inter-linkages possible.

And again each cell is a microcosm, for within the colloidal contents or cytoplasm (in part consisting of true living matter or protoplasm) there floats a kernel or nucleus which contains forty-seven (in woman forty-eight) rodlets or chromosomes, each with a bead-like arrangement of smaller microsomes, and so on till we reach the invisible (yet not unmeasurable) " genes " or hereditary " factors "—the initiatives of the various distinctive " unit-characters " of the body. We see that the nucleus of the cell is a little world in itself, and the cell may also include centrosomes, mitochondria, chromidia and so forth, with untold complexities of interaction. And a remarkable fact is that when a typical growing cell divides, there is a meticulous halving of everything—chromosomes, centrosome, mitochondria—everything. By a complicated sequence of manœuvres in all ordinary cells of plants and of animals, it comes about that each daughter-cell is a replica of the parent-cell.

(IV) Also to be taken account of is the world-wide *adaptiveness* of living creatures. Every complex organism is a bundle of fitnesses. Some are no doubt more striking than others ; thus, as a great biologist once said, if one takes away all the adaptations from a whale, what is there left ? In fact, wherever there is intricacy of structure or subtlety of function in plant or animal, adaptations abound ; and while we can no longer agree with Paley in directly arguing from these to a Divine Artificer, we cannot ignore one of the largest facts of life, that living creatures are adaptive through and through. The creative institution of the Order of Nature was evidently such that more and more perfectly adapted organisms have emerged in the course of evolution.

(V) Apart from parasites, which often establish a *modus vivendi* with their host, there is very little trace of disease in Wild Nature, though it may become rife when man interferes, with a grasp more greedy than skilful. And what strikes the trained observer as characteristic of Wild Nature is more than the rarity of constitutional, functional or environmental disease ; there is an exuberance of *positive health*. No doubt there are parasites, living a drifting life of ease ; degenerates that have settled down into easy-going sedentariness ; and retrogrades that have, for various reasons, lapsed from the level reached by their ancestors ; but these are exceptional. What is characteristic of Wild Nature is the lit lamp and the girt loin, the vigour of positive health.

And if disease be defined as disintegrative disturbance of the well-balanced metabolism or chemical routine of the body, we can understand why it should be so often associated in mankind with ugliness, whereas harmonious orderliness of life makes for beauty. Some animals fail to please our æsthetic sense, which is often over-conventionalised, and thus we invent popular names like " devil-fish " and technical names like *Moloch horridus*, but the artist is delighted with both these creatures. Grotesque they may be, but not ugly. Just as with pictures, so among organisms there is difficult as well as easy beauty. Thus anyone can admire the peacock's tail : it needs a Ruskin to perceive the sinister beauty of the snake. Not only is organic beauty an expression of orderly and integrative vital processes, it often bears the marks of the animal's strenuous, graceful and eurhythmic movements ; and sometimes we may go the length of saying that beautiful features are, as the poet discerned, " chiselled from within," especially when there is a strong emotional life, as in birds. But the point is the pervasiveness of beauty among living creatures. It is part of the picture, as real as metabolism. Surely Lotze was right, that it is of high value to look upon beauty not as a stranger in the world, nor as a casual aspect of certain phenomena, but as the " fortunate revelation of that principle which permeates all reality with its living activity."

(VI) Not much can be said in regard to the mental aspect of the life of the lower animals, and still less when we turn to plants ; and yet it is impossible, we think, to do anything like justice to the behaviour of higher animals without crediting them with minds that count. It is not a question of our being generous or parsimonious, the point is whether we can give an adequate description of the higher reaches of animal life on apsychic lines. Excepting the extreme behaviourists, science agrees with common sense in declaring this impossible. There are animal " minds " that count for something ; and we cannot make sense of what we see unless we credit the animal with an inner subjective life of feeling, imaging and purposing—analogous to our own. And just as we watch every day the development of mind in the individual child, from the simplest and vaguest expressions of infancy to the epiphany of lively intelligence, joyous emotion and eager will, so looking at racial evolution we must search among the lower animals for the early stirrings of mind. The biologist is not likely to forget Spinoza's warning, that we must not be too quick to decide what the body, *as body*, may not do ; but there is a growing array of facts, such as the modern study of the Anthropoid Apes, pointing in the direction of more Psycho-biology, as well as more Bio-psychology. In other words, the biologist is finding it necessary to study the higher animal as a MIND-body and as a BODY-mind alternately. No one wishes to over-emphasise the psychical aspect of the lower animals or of plants, since it is obviously difficult to give content to the concept at these low levels ; but if there is continuity in organic evolution we must expect to find the dim analogues of mind even in the Protozoa. " Mind " or " sentience " is probably conterminous with life itself.

(VII) The crowning wonder of life, giving significance to the whole picture, is the fact of Organic Evolution. We have already mentioned evolvability as one of the nine characteristics of organisms, but we must not lose the drama in the doctrine. It is not merely that birds evolved from reptiles, these from amphibians, and these from fishes ; the concept of Organic Evolution is much more than a system of pedigrees. We must have some vision of the succession of achievements, such as the firs body, the first sex, the first limbs, the first brain. What acquisitions ar suggested by the words—blood, eye, voice, " warm-blooded," vivi parous ? We must have some picture of the gradual peopling of the wide wide world by plants and animals ; of the repeated colonisations of th dry land, and the far-reaching consequences of each ; and of the insurgen possession of every niche of opportunity. We must imagine the change of the world stage in successive geological periods, and how these, nc least those of climate, involved new motives in the drama and new pitfall as well. There has been an evolution of sieves as well as of material t be sifted. Nor can we afford to ignore the gradual weaving of the we of life, the linking of living creatures together in subtle interrelation This is characteristic of life, that it forms a *systema naturæ*, which serve as a subtle sieve for new departures or variations, and also tends to lesse the risk of retrogression. Animate Nature is a fabric, with a changin pattern ; and man insists on sharing in the weaving.

To sum up : our argument is that the picture of organisms that mu form part of our synoptic or philosophical view, should include som appreciation of the power of life, the multitudinousness of specific ind vidualities, the astounding intricacy, the pervading fitness, the practic omnipresence of beauty, the interactions of mind and body, and th dramatic character of Organic Evolution.

DESCRIPTIVE NATURALISM

The biologist seeks to describe, as simply and tersely as possibl what happens in Animate Nature and in individual organisms, and h does so in terms of factors which are experimentally verifiable in th system of things which he observes. His universe of discourse includ the minds of animals, so far as these are demonstrable, but it does n include anything mystical or transcendental. One of the greatest naturalists, Darwin's magnanimous colleague Alfred Russel Wallac went beyond Biology and beyond science when he postulated speci " spiritual influxes " to account for various " big lifts " in evolutio That was departing from the method of *descriptive naturalism*, whic keeps to empirical formulæ, trying to account for the facts of life, in th case of Biology, in terms of the factors known to be resident in organism and their surroundings. *What are these factors ?* They include :—

(*a*) Chemical and physical processes, operative in and arour organisms ;

(*b*) Qualities of protoplasm that remain at present in greater part i reducible, such as irritability, persistence or inertia, growth and d velopment ; and

(*c*) Resident mental or psychical activities, when these are co vincingly recognisable as at work.

It must be clearly understood that scientific naturalistic *descripti* does not imply what is called philosophical naturalism, which denies t validity of all transcendental or spiritual *interpretation*. For while scien answers the questions *What?* *Whence?* and *How?* it never even asks the question *Why?* In other words, science does not raise the philosophical or religious question of the meaning, significance or purpose behind the world of the measurable. It does not inquire into the original Beginning or the Essence of things. But what the biologist has to aim at in this connexion is the working out of an empirical description which will be as exact and impersonal as possible, and verifiable by all normally constituted minds who can use the methods. Of all science, but of Biology in particular, it must be understood that it is a partial and abstract inquiry, based on observational and experimental methods devised to detect and measure (or register) certain orders of fact, and these only. As we have often said, the biologist, as biologist, dredges in the sea of reality with nets of a certain kind of mesh (his biological methods), and is naturally restricted to the capture of certain kinds of fishes. As a man he may appreciate beauty ; as a biologist he does not catch it except in rare cases ; *.g.*, when it operates as a factor in the courtship of birds. More generally, if he has arranged the meshes of his net so that they will only catch metabolism, he cannot expect to discover Mind in his sea. None the less, he may be well aware of it, and thus becomes psycho-biologist. Of course he biologist cannot be sure that his science has as yet come to know all he factors operative in Animate Nature, but he should none the less remain radically opposed to every attempt to eke out empirical factors with ubsidies from transcendental treasuries.

VITALISM

The biologist seeks to avoid all " isms " except organism. He has the difficult task of steering between a metaphysical Scylla and a materialistic Charybdis. His only safety is to keep close to the facts of the case, and hat is easier said than done. On the one hand, it is plain that there are hemical and physical processes always going on in the living organism, and o do justice to these—a fruitful pathway of discovery—is what Comte alled " legitimate materialism." Living matter is in a colloidal state, and much that goes on in the living cell must be described as far as possible n terms of the properties of colloids. Innumerable ultra-microscopic articles and unmixing droplets of proteins and other carbon-compounds re suspended in a fluid medium, and their surfaces, very large in proportion to the total volume, afford vast opportunity for physical and chemical hanges. We may repeat our useful metaphor, that the invisible particles, whose refractive haloes are sometimes demonstrable in the strong light f an ultra-microscope, may be compared to the islets of an archipelago, whose coast lines, large in proportion to total area, afford opportunity for much trading. Similarly, the biologist must take account of the surface-tensions, the capillarities, the absorptions and adsorptions, the diffusions nd so forth, that are observable in the living. Much is to be learned from io-physics and bio-mechanics, yet the biologist finds that organism ranscends mechanism.

So with bio-chemistry, a very illuminating contact of two sciences. In he living body there is an interplay of oxidations, reductions, hydrations, ehydrations, fermentations and so forth ; and the science of the living body cannot afford to ignore any one of them. Yet the biologist clings rightly to the autonomy or independence of his science, since he does not find it possible to give an adequate description of the behaviour, the development, the evolution and the other outstanding features of the organism in terms of bio-physics and bio-chemistry. Abstracted corners may be so described, but no *complete vital phenomenon* has as yet found adequate chemico-physical description; there is some integration o regulatedness or registration of previous individual and racial experience a purposiveness which is beyond purely chemical and physical formulation—indispensable as these are. Such familiar occurrences as the winking of an eye do not in the present state of science admit of being satisfactorily described in terms of chemistry and physics, but require, in addition, distinctively biological concepts, which might be called organismal such as growth, development, enregistration and integration. Our position, which may be technically called " methodological vitalism," differ from positive vitalism in not postulating any " vital force," " entelechy," " élan vital," or other *x*, but in simply saying that, as a matter of fact organisms require for their scientific description certain biological concepts or categories which are at present irreducible. It differs from th mechanistic position in maintaining that the organism, even when it ha no demonstrable mental aspect, is more than any mechanism. A nev aspect of reality emerged when life began. In other words, the firs organisms were new " wholes," new syntheses, which made the worl new.

PSYCHO-BIOLOGY

When we come to know the behaviour of living creatures intimatel we make two discoveries that are at first sight somewhat divergent. W find that many activities that seemed, to begin with, clever, are reall automatic, in the sense that they do not require conscious control. The are reflex, as when the earthworm jerks itself back into its burrow; c tropistic, as when the young eels make steadily upstream all the lon spring day; or rhythmic, as when the green Convoluta worm comes t the surface of the sand at the ebb of the tide, and retires again at the firs splash of the incoming flow; or instinctive, as when the young spider o its first attempt constructs an intricate web true to type. In the course c Organic Evolution there has evidently been a tendency to enregister in th hereditary constitution ready-made responses to normal circumstance Care must also be taken to do justice to the individual development c what Pavlov has called " conditioned reflexes," which play an importa part in the life of man and beast.[1]

On the other hand, among the higher animals, such as birds and mammals, there are indubitable evidences of intelligence, of putting two an two together, of making a simple inference, of profiting by experience, c " learning " to live effectively. We must use the term *intelligent* when w cannot describe the behaviour without giving the animal credit for " perceptual inference," a sort of picture-logic. And even when the behaviou cannot be called intelligent, as in a ganglion-less starfish, there may be initiative and experiment, something on a quite different line from enregistered response. But from the amœba, engaged in hunting a smaller amœba, up to the chimpanzee, engaged in joining two bamboo lengths together to make a rod long enough to reach a coveted fruit, there is evidence of mentality ; and when it does not take the form of experiment, imaging or ideation, it may be expressed in joy and in the bent bow of purpose. Apart from the extreme behaviourists who maintain that mental activities are only the foam-bells on the stream of nervous activities or neuroses, all naturalists are agreed that animal behaviour is shot through and through with a subjectivity that operates as a *vera causa*, whether it be the emotion of the nightingale or the well-laid schemes of the resourceful otter. Even in the very thoroughgoing instinctive behaviour of ants and bees there are passages which seem to demand flashes of intelligence.

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[1] These are dealt with in the Article on *Psychology*, p. 329.

Among higher animals, the higher mammals in particular, there is an undeniable mental or psychical life analogous to our own, with inferences, emotions, purposings and the like comparable to ours. Yet there is no warrant for crediting animals with " *Conceptual* inference " or experimenting with general ideas. They may rise to intelligent reasoning, but they have not Reason in the sense of conceptual inference. In the same way, while many birds and beasts have words, none can be credited with language in the strict sense—the expression of judgments by means of socially imitated sounds. These two prerogatives, Reason and Language, give man a position higher than that of animals, and it is also evident that in mankind the *social heritage* of extra-organismal gains—as in literature, art, institutions and permanent products—plays a very important part, supplementary to that of the *natural inheritance*, enregistered in the germplasm. Among animals there are hardly more than adumbrations of this social heritage, but some of these, notably the ant-hill and the beehive and the termitary, are of surpassing interest. But our present point is the simple one, that mental or psychical activity, which is such a powerful stream in Man, is more or less recognisable in many animals, even if it has not become more than a slender rill. If it were not so, Man would appear as a discontinuity in Organic Evolution, and the drama of animal life would appear as a magical puppet-show. However the fact may be expressed, the mental activity in a dog or a horse is as real as the metabolism, the psychosis as real as the neurosis.

The progress of biological research on the two sides of neurology and ecology has shown very clearly the closeness of the inter-relation between the neural and the psychical. The mind is " thirled " to the body, and the body is thrilled by the mind. Good news helps digestion ; strong circulation helps clearness of thought. The various grades of chloroforming correspond to the stoppage of mental currents at successively deeper levels. As the body develops so does the mind ; and a thyroid deficiency may spell disaster to the latter as much as to the former.

Some biologists of distinction picture the mind as a musician playing on the instrument of the body (a dualistic view) ; others of equal distinction, think of mental activity and nervous activity as two inseparable aspects of one reality—the life of the organism, which has two inseparable sides like the inner concave and the outer concave surfaces of a dome (monistic view). Many other biologists regard the perennial problem as limiting one for human intelligence as far as that has yet developed. It i for the philosopher to help the biologist to ask aright the question of th relation between " Body " and " Mind " ; but it is for the biologist t keep to the facts of the case and to make it clear that the organism is ver often almost entirely physiological, with just traces of the psychological while at other times it is conspicuously psychological, with an undercurrent of the physiological. The Yellow Bunting in flight is an extraordinarily dynamic engine or collocation of engines ; but it has a menta picture of its home-tree, a picture inspired with tender emotion, and wit memories of mating, nesting and parentage. It is not a mere body ; it i BODY-mind ; its description implies BIO-psychosis. At another time it i singing to its mate ; mentality is in the ascendant ; it is embodied min or MIND-body ; its description implies PSYCHO-biosis. In using thes useful compound words, due to Alexander Bain, it is probably clearest t put the dominant aspect first—BODY-mind in the homing bird, but MIND-body when the nightingale sings.

ORGANIC EVOLUTION

The term evolution is used in so many different connexions that it requires an adjective in front of it to give it precision. Thus in *cosmic* evolution, say, of a solar system, there is no succession of generations no struggle for existence, as is characteristic of organic evolution. There i *chemical* evolution when uranium gives rise to radium, and radium t lead ; but this is very different from reptiles giving rise to birds, or th wild Rock Dove to domesticated races of pigeons. And again, to give onl one other example, *social* evolution implies some awareness of past histor and some reasoned guidance towards a future, which cannot be said of th evolution of plants and animals. Yet the fact that some higher animals pla an intelligent part in their own endeavours indicates the difficulty of drawing hard-and-fast lines and excluding some perception of a goal. Similarly looking in the other—the physically determined—direction, we recognis the fact that gamma-rays sometimes play a part in evoking organi variations; and we remember that in a series of related species of, say, ros the chromosomes in the nucleus of each cell number 7, 14, 28 and 56 fo the different kinds. *Organic* evolution is different from social evolutio and from chemical evolution, but it cannot be considered altogether apart since human society is its climax, and since even the most enminde organism is a collocation of matter and energy in a material and energeti environment. All evolution is a process of becoming, in which the presen is the child of the past and the parent of the future, but Organic Evolution may be defined as a process of racial change in a definite directio in the course of which new forms emerge and may be established alongside of or in place of the originative stock. So the first birds emerge from a reptilian stock. Evolution is a natural process comparable to tha by which man has established so many different breeds of poultry fro the wild jungle fowl, *Gallus bankiva*, of India, and so many differen varieties of wheat from the wild wheat still growing on the shoulders o

Mount Hermon ; but what corresponds to man's sifting and singling is to be looked for and found in the processes of selection and isolation verifiable throughout Animate Nature.

From our present point of view it is all-important that the picture of Organic Evolution which Biology contributes to the philosophical synoptic view should be as accurate as is possible. But it must be patiently kept in mind that the whole inquiry is still very young. It was not till the work of Darwin (1859) and the anticipations of a few precursors that Ætiology began to be taken seriously !

Modern Evolution theory has not advanced in idea very far beyond Darwinism, but there has been a great extension of knowledge (as to heredity in particular), and on some lines a deepened understanding. The central Darwinian theory was based on the following propositions :

(*a*) Novelties, new departures, or variations are of frequent occurrence ;

(*b*) Some of them are hereditarily continued in subsequent generations, and only those thus " transmitted " can have direct evolutionary importance ;

(*c*) Some variations, distinguishing offspring from parents, or the members of one family from one another, are in one way or another advantageous to their possessors ;

(*d*) For various reasons, such as rapid multiplication, limited space and food, the changefulness of the callous environment, and the insurgence natural to vigorous organisms, there is a manifold, unceasing, intense, and often very subtle struggle for existence ;

(*e*) In the course of this struggle for existence, when organisms come up against environing difficulties and limitations, there is a process of selection which favours the possessors of the variations that are relatively advantageous in the struggle, and tends to eliminate, quickly or slowly, those that are without them ; and

(*f*) There may also be factors securing some form of isolation for new departures, so that they tend to breed together, thus stabilising their advantageous features. A simple case of this is when new varieties on a peninsula are insulated by some geological change.

In short, the central ideas of Darwinism are : variation, heredity, struggle, election and isolation ; and modern ætiological research has not yet disclosed any other factors in organic evolution. But evolution theory is evolving—it would be strange if it did not—and we wish to conclude this outline of the biological contributions to philosophy by noticing a few of the post-Darwinian steps that seem to be particularly progressive.

As Regards Variations

One of the central problems of Biology is the origin of the new, for it s by the sifting of newnesses or variations that the ascent of life has come bout. In other words, variations or mutations supply the raw material of evolution ; and this has been for the most part progressive or integrative, hough from time to time, in diverse types, retrogressive and degenerative, as in the familiar case of parasites. One of the things we are tired of hearing is that Darwinism accounts for the survival, not for the arrival of the fit ; but Darwin was quite clear that Nature’s sifting or Natural Selection operates on the novelties or variations that are submitted to it, and these are of very frequent occurrence in Nature. Natural Selection prunes the new shoots on the *arbor vitæ*, but neither Darwin nor any careful biologist ever supposed that the pruning-hooks accounted for the tree or for its new shoots. Darwin began the scientific study of variations, in regard to which he said, with his usual frankness, that our ignorance is immense We may say the same to-day, yet considerable progress has been made To Weismann in particular we owe the clearing up of the idea, obscure to Darwin, that variations have *a germinal origin*. The newnesses may no find visible expression until embryonic life is over, or even until adult life begins, but the originative change is to be looked for in some permutation and combination within the complex germ-plasm of the egg-cells and sperm-cells—either in their making, or in their maturing, or in thei union at fertilisation. If we compare the hereditary initiatives, technically called “ factors,” “ genes,” or “ determinants,” to the cards of a pack many opportunities for shuffling are afforded by the intricate manœuvre of the nuclear rods or chromosomes in which the genes are located in each germ-cell. Very important, for instance, is the reduction-division o meiosis which occurs at the ripening or maturation of the egg-cell and o the sperm-cell, for in this peculiar mode of cell-division the number o chromosomes is reduced by a half, the normal number being restored when a “ reduced ” egg-cell and a “ reduced ” sperm-cell unite in fertilisation—which may be defined as the intimate and orderly union which is the beginning of each new individual organism, if reproduced in th ordinary way. In the halving of the number of the chromosomes in maturation, and in the restoring of the normal number in fertilisation, there ar opportunities for novel permutations and combinations—in other words for *the origin of the new*.

There is also a remarkable process of “ crossing-over ” between tw adjacent chromosomes lying together inside the nucleus, for an area of th one passes over and changes places with an equal area in the other. A the genes, though invisible, are known to lie in linear order in each chromosome, the “ crossing-over ” affords yet another possibility of permutation and combination.

Then there is the pooling of the two “ reduced ” sets of chromosome that occurs in the microscopic process of fertilisation, to which Weisman applied the term “ amphimixis ”—the mingling of the paternal an maternal inheritances—each complete in itself, though differing in details Moreover, one must think of the amphimixis not as the mere mingling o two complex organic substances—half paternal and half maternal : it i the union of two living units or implicit organisms to form one—th fertilised egg-cell. The fertilisation nucleus, with an equal number o chromosomes from each parent, is a reorganised unity which initiates th development of a new individuality. The re-organisation promotes novelties and it also tends to nip the incompatible and the pathological in th bud. One reason why mules, such excellent animals in themselves, ar rarely fertile is probably some incompatibility in the chromosomes of th two parents—the horse and the ass. The first generation succeeds, but there are rarely any more. In the great majority of animals, the crossing of two distinct species is unsuccessful in yielding even one generation of hybrid offspring.

As knowledge grows, the fortuitous seems to shrivel. Variation occurs within limits, within limits narrower than those seen in a kaleidoscope. The new departures must be congruent with what has been already established, just as the novelties that an architect will sanction in adding to a building must be in keeping with the style of what has gone before. In many cases variations in plants or animals are quantitative—a little more of this, and a little less of that, a longer wing and a shorter tail; and Darwin placed great reliance on the selection and hereditary accumulation of those small quantitative variations that are advantageous to their possessors, or conversely on the persistent elimination of those variants in which the new departure is on the disadvantageous side. One must, of course, draw a firm distinction between a variation that is disadvantageous and one that is positively pathological. For in Wild Nature the outcrop of anything pathological or disintegrative seems to be a great rarity, and likely to be nipped in the bud if it occurs. There is very little hint of congenital or constitutional disease in Wild Nature.

Another glimpse of *the frequent definiteness of evolution* is to be found n those rock-records where there is a very perfect preservation of fossil orms. There is sometimes, as in fresh-water snails, or in nautiloids and mmonites, an extraordinary gradation of species—F very different rom A, yet connected ever so gradually to A through the intermediate B, C, D, E species or sub-species. In other words, the stages in racial evolution look like the stages in individual development, all is so gradual. To some extent this apparent definiteness of variation—this orthogenesis, as it is called—may be due to the fact that divergent variants were eliminated, but it is strange that these hypothetical divergent variants should be o rarely represented as fossils in these orthogenetic series. In other, more igzag, lineages the occurrence of divergent forms, off the main line, is ften very convincingly documented in the rocks.

Yet another glimpse of the definiteness of variability is seen in those eries of species, to which we already referred, which show an arithmeical orderliness in the number of chromosomes in their cells. Thus there re species of rose with 7, 14, 28 and 56 chromosomes; and this is but one xample out of many. Thus there are often quantitative differences beween related species that recall those between related chemical elements.

Another good reason for discarding the nightmare idea that chance ariations furnish the raw materials of evolution may be suggested. A erminal variation, *i.e.*, some new departure in a germ-cell, might well ake the form of a change of metabolism involving an extra-production of ome ferment, or implying an extra growing power in, say, the ectoderm r outer-layer cells, or leading to increased storage of reserves, and so orth. This variation has opportunity for expression in the development f the offspring, but there it finds itself in certain physiological and morhological trammels. It is not anything that can find expression: there re only a few possibilities open. Just as there are only some half-dozen reat types of architecture among crystals, so there is but a limited number of ways in which multiplying embryonic cells can arrange themselves. What is even more important are the physiological limitations established in living creatures that have been going concerns for millions of years. Thus in an ordinary higher plant, where the antithesis between foliar nutrition (leafing) and floral reproduction (flowering) is so pronounced, variations are likely to find expression in an emphasis on the one or the other. Thus, as Patrick Geddes has well shown, there is in evolution an ever-recurrent dichotomy or forking of the ways between the more grassy and the more orchidaceous, between the more leafy and the more floral. Thus plants with almost invisible flowers but abundan foliage are to be contrasted with the sparsely leafed, but exuberantly floral, such as the extreme case of the parasitic Rafflesia where the vegetative system is almost unrepresented, and there is a colossal flower a yard across ; but this contrast is not that of fortuitous variations gradually selected as adaptations to different life-conditions, but rather that between the extremes of two trends—foliar or floral—that are of genera occurrence. Similarly many evolutionary trends in higher plants are concerned with a lengthening out or a shortening down of the floral axis—two obvious developmental possibilities. So the new is not the fortuitous but a fresh expression of individuality within certain constitutional limits

Among animals a continual physiological alternative seems to have been between speeding-up and slowing-down; *e.g.*, between avian and reptilian types, but this dichotomy or forking of the ways is plainly related to the fact that metabolism has these two aspects, downbreaking or katabolism and upbuilding or anabolism. Or again, a typical life-history shows in varied guise an ascending and a descending curve, like an old-fashioned bridge—an ascent from embryo to larva, from larva to adolescent, from adolescent to maturity and parentage, whence the downgrade to ageing and senescence. Germinal variations may find expression in a lengthening-out or a shortening-down of a particular arc on the life-curve. In this wa different types of life-history in related organisms have arisen, and afte this deeper rationale is appreciated, it is time to turn to their selecte adaptiveness to particular conditions of life.

Variations are broadly distinguishable as (1) minute *fluctations* of quantitative character, which may mean much, as Darwin thought, long continued and accumulated, *e.g.*, a lengthening of the feathers o flight ; and (2) brusque *mutations* of a qualitative character, which make definite step, large or small, without gradated intermediate stages, *e.g.*, white blackbird. Darwin was much interested in discontinuous variation or mutations (also called "saltatory," "brusque," "sports,") but though that they would be averaged off in crossing. It is now known, however, tha when mutations come, they usually come to stay ; they take a strong hereditary grip ; as will be explained later on, they illustrate Mendelian inheritanc

We must admit, however, that it is especially when we consider mutations, where something distinctively novel suddenly emerges, that w feel the inadequacy of our knowledge in regard to the origin of the new Let us sum up the possibilities :—

(1) Novelties may arise in kaleidoscopic fashion by new permutations and combinations of the hereditary factors or genes, notably i

maturation, "crossing over," and fertilisation. To some extent this may be thought of as shuffling of the hereditary cards.

(2) Changes in the nutritive stream within the body may provoke changes in the nature of the genes—a factor to which Weismann was for a time inclined to attach much importance. There can be no doubt that some changes in diet effect some novelty in the offspring.

(3) Important changes in the body, induced by environmental and functional modifications of a penetrating nature, *e.g.*, change of climate, may evoke changes of some sort in the germ-cells, though it would seem that these are not (as far as known) such that the original parental modifications reappear hereditarily in the offspring. A modification may be defined as a structural change in the body directly induced in the individual life-time by some peculiarity in surroundings, food or habits.

(4) Deeply penetrating environmental changes, saturating through the body, may provoke changes in the genes, as may be illustrated by recent experiments which indicate that gamma-rays may serve as variational stimuli, provoking the genes to change. Thus change of climate may induce changes in a race.

(5) There may be, as Weismann suggested, some form of germinal struggle and selection among the hereditary initiatives or determinants; thus if a particular kind is in course of being weakened by some variational trend, this deterioration may be hastened by some subtle form of intra-cellular competition. This is called "germinal selection"; but few biologists seem to favour the hypothesis.

(6) Just as a slipper-animalcule (Paramecium) may in certain conditions exhibit a remarkable process of scrapping and re-organisation called "endomixis," so there may be in the germ-cells a re-arrangement of materials; and here there is also some suggestiveness in the sudden way in which some microbes change their character from virulence to innocence, or conversely. We must never lose sight of the commonplace, that the germ-cells are living unities—implicit organisms.

(7) Finally, in regard to this central problem of Biology, the origin of the distinctively new, it may be suggested that it is difficult to think of a germ-cell, of a higher animal at least, as being without its psychical aspect. Unless we think of "the mind" as entering in at a later stage in development, the germ-cell must have a dim primordium of the subjective, the promise and potency of mentality. If so, it is easier to credit the microscopic implicit organism, as rich in initiatives as a germ-cell is, with making experiments of some sort in self-expression; and that is what mutations are. Perhaps we exaggerate the difficulty of the problem because we are so slow to take the psycho-biological point of view. That mind may influence body in the highest expressions of both is a certainty of experience, though we cannot explain how it is done; perhaps the same holds in the apparently simplest cases of germ-cells on the one hand and unicellulars on the other, that the first stirrings of what will be individual and racial mind are not without influence.

As Regards Heredity

Heredity is no "force" or "principle" or "entity," but a flesh-and-blood (or genetic) relation between successive generations, such that like necessarily tends to beget like. This depends on *the continuity of the germ-cells*, a fact brought into prominence by Weismann. What it means is that, that if a fertilised egg-cell be thought of as containing the initiatives or " factors " of a number of qualities, *a*, *b*, *c* . . . *x*, *y*, *z*, it divides into many cells in which these same qualities are continued, for ordinary cell-division, as we have already mentioned, is meticulously exact. But while the great majority of the cells of the developing body undergo division of labour, whose structural aspect is called differentiation, some expressing more of the qualities *a*, *b*, and others more of the qualities, *y*, *z*, and so on, there are other cells which do not share in body-making, but retain in unspecialised intactness the original qualities, or initiatives of qualities, *a*, *b*, *c* . . . *x*, *y*, *z* ; and these cells become the foundations of the reproductive organs of the offspring. They form other cells like themselves, that is to say, more germ-cells, and some of these are in due time liberated to start another generation. As these germ-cells (the egg-cells and sperm-cells) have in intactness the qualities *a*, *b*, *c* . . . *x*, *y*, *z*, they will develop into similar organisms, provided always that the appropriate environment is forthcoming. Thus there is a continuance of a specific organisation from parents to offspring and so forth ; and this continuance, not very happily termed transmission, is the central fact in heredity.

Yet we can only say that like *tends* to beget like, for heredity includes the possibility of variation, which is an incompleteness or change in the hereditary resemblance. The inheritance, the " natural inheritance " as Galton called it, includes all that the organism is or has to start with in virtue of its hereditary relation with its parents and ancestors ; and this implies the inclusion of any novelty or variation which may have occurred, as we have explained, in the intricate history of the germ-cells. Any viable inborn novelty of germinal original is *ipso facto* transmissible or continuable ; and no organic change that is not proved to be transmissible can have a direct part in evolution. Thus heredity is a condition of evolution.

This raises the much-discussed question whether individual modifications, badly called, " acquired characters," can be handed on as such, or in any representative degree, to succeeding generations. As we have already said, a modification is an individually acquired bodily change, directly due to some peculiarity in functioning, nutrition or environment, which so transcends the limits of organic elasticity that it persists after the inducing causes have ceased to operate. Exercise strengthens a muscle ; sluggishness leads to a deposit of fat ; deficient food brings about a degeneration ; altered diet is followed by a change in the wall of the gull's stomach ; total darkness leads to the gold-fish becoming quite blind ; a man becomes tanned in the course of years of work in India ; a sheep transported to a cold country thickens its fleece ; a white Proteus from the Dalmation caves soon becomes dark-coloured in a well-lighted laboratory ; and so on through a very long list.

But if we ask whether these modifications can be hereditarily continued or entailed on the next generation, even in a slight representative degree, the evidence for the affirmative is very far from convincing. Modifications are often of great importance for the individual organism that acquires them, but they do not seem to be handed on as such, and if so they cannot be of direct importance in the evolution of the race. There are some puzzling cases which lead the cautious biologist to keep the question open, but on the whole it must be said that there is little convincing evidence to show that a bodily modification is ever continued in the inheritance. This should not lead to any depreciation of the importance of nurture, or of changed nurture, for the individual, since the same advantageous modifications can be hammered on afresh for each successive crop of organisms ; and disadvantageous modifications may be similarly evaded. It should also be noted, as Weismann always emphasised in his criticism of Lamarckian theory, that some deeply saturating influences, say of food and climate, may influence the entire organism, including its germ-cells, so that the germ-plasm may be affected, for better or for worse, *along with the body* ; and a germinal change thus induced would naturally find expression in the next generation. But this is very different from Lamarck's theory that modern giraffes have long necks because of the hereditary cumulation of the minute increases acquired by many generations of ancestors who stretched out their cervical vertebræ as they reached up to the leaves on higher branches. It is very different from Herbert Spencer's theory that he had small hands because his father and grandfather, being schoolmasters, were habituated to such neat manipulations as sharpening pencils ! Yet as it appears to many incredible that experience should not count at all as a factor in organic evolution, it must be noted that this depreciation of the importance of individual experience is not involved in a rejection of the evidence adduced in support of Lamarck's theory of *direct* adaptation through use and disuse. Experience has certainly counted, for it is in their daily experience and in expressions of their new desires and needs (Lamarck's *besoin*) that organisms test the novelties with which germinal variability has endowed them. It is in experience that new departures are tested, and the testing often determines whether they are continued to many offspring, or to few, or to none at all.

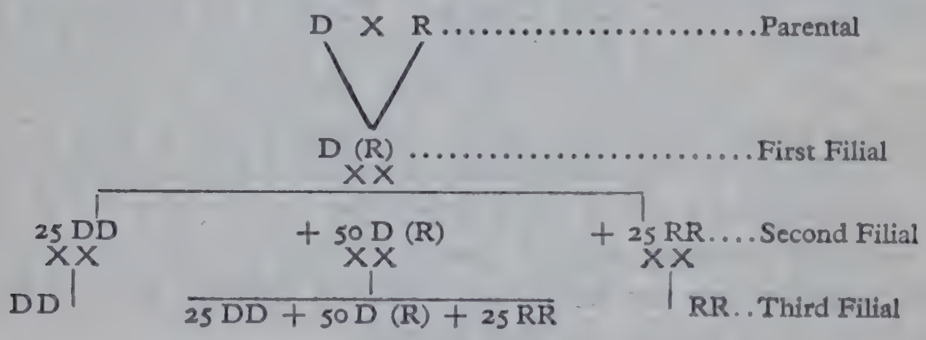
In viviparous organisms, such as seed-bearing plants and all mammals save two, there is a more or less prolonged partnership between the offspring and the parent. The seed is a young plant intimately bound to its parent, often for a long time before it is scattered. The unborn young mammal is bound to the wall of its mother's womb in a very intimate partnership, which might well be called symbiosis. In both these cases it is plain that the young creature may be profoundly influenced while it is still in organic continuity with its parent, and though this influence, both plus and minus, is not in the strict sense part of its inheritance, it may count for the individual offspring as if it were. Thus there may be a general strengthening or a general weakening of the young mammal's constitution according as the mother's health is vigorous or depressed. But this is certainly not what is meant by " the transmission of an acquired character."

Here, also, it may be noted, as before, that in mankind the extra-organismal inheritance, usefully called the *social* heritage, may have an influence on the offspring so powerful that it may be compared to that of the *natural inheritance*, whose bearer is the germ-plasm. In social animals, such as ants and bees, rooks and beavers, there is a dim adumbration of the social heritage which becomes so determinative in man, and is indeed one of the criteria of the sociological as different from the biological. More and more in modern times does the social heritage become the custodian of human progress ; yet the inheritance of a healthy body is as fundamental as the heritage of truth, beauty and goodness is supreme.

The whole science of heredity has been changed by the discovery of " Mendelian Inheritance " by the Abbot Mendel in 1865, and by its rediscovery by De Vries, Correns and Tschermak in 1900. Every inheritance is largely made up of a series of " unit characters," which do not blend or break up, but remain intact from generation to generation. So far as is known these " unit characters " are represented in the germ-plasm by ultra-microscopic differentiations localised, in linear order, in the chromosomes of the nucleus of the egg-cell and sperm-cell ; and, as we have already noted, they are called hereditary " factors," " genes," or " determinants." They are invisible, but they are not symbols ; they are living initiatives of subsequent differentiations, leading to what are called the hereditary characters of the organism. But several genes may be concerned in determining one character, such as the colour of the hair ; and one gene may influence the development of several characters, as some change in the chemical routine may readily do. A gene or a linkage of genes may germinally represent a large constitutional peculiarity, such as sex or rapidity of reaction or immunity to some disease ; at the other extreme it may be the determinant of some triviality, such as some new grimace on a snapdragon flower or a new colour in a fruit-fly's eye.

These unit characters, whose origin has been well-studied, since they recur under observation and in experimental conditions, are known to arise as mutations, that is to say, as sharply-defined, brusque novelties which are not connected by intergrades with the condition found in the originative stock. They may be large or small, important or trivial ; but they all behave in the same way in inheritance, they do not blend or break up, they " mendelise." As instances may be named : gigantism or dwarfism in peas, green or yellow seed colour in peas, the colour of the iris, short hair or Angora hair in rabbits, crests in poultry or none, horns in cattle or none, bands on a wood-snail's shell or none, night-blindness or normal sight in man, broodiness or its absence in hens, dentate or entire margin in nettle-leaves, and so on through scores of well-established cases. The drawback, indeed, to giving a list of instances is that we are thereby apt to obscure the fact that a very large number of hereditary features have been shown to be unit characters which mendelise.

As an example of Mendelian Inheritance, and that is all that can be attempted here, let us take the picturesque case of the Japanese waltzing or dancing mouse. This variety of the common mouse has some obscure peculiarity in its nervous system that behaves as a unit character. It has the habit of dancing round in circles, and with this other idiosyncrasies, such as deafness, are associated. Now if a waltzing mouse be paired with a normal mouse, all the offspring are normal ; and this fact is expressed in the statement that normality is dominant and waltzing recessive. But if the apparently normal hybrid offspring, the first filial (F.1) generation, pair amongst themselves or with others like themselves of similar history, what is the character of the second filial (F.2) generation ? Mendel found that, on an average, 75 per cent. will show the dominant feature and 25 the recessive. In other words, in a dozen F.2 mice (of the history just given) there will be nine normals and three waltzers. If these waltzers are paired together, or with others of similar history, they will yield waltzers only—leading on to a future lineage of perfectly pure recessives, as long as no dominants are allowed to mingle with them. As to the 75 per cent. of dominants, a third of them are shown by breeding to be pure dominants comparable to the pure recessives, while two-thirds of them will be impure dominants like their immediate parents—apparently, but not really normal. If these are bred together they will yield the same proportion of three normals to one waltzer ; and of the three normals one will be genetically wholly normal, while two will have the recessive or waltzing character unexpressed in development, but latent in some of the germ-cells, as further breeding shows. If we use the letters " D " and " R " for the dominant and recessive characters respectively, and allow them for shortness to stand for the possessors of the respective characters, then the Mendelian rule may be briefly expressed in schematic form :—



Here D (R) means that the recessive character, though not patent, is latent in the inheritance. The doubling of the letters (DD and RR) means extracted (or genetically pure) dominants or recessives. The inbreeding of similars is indicated by the two crosses (XX). Returning to the waltzing mouse, we see that all in the hybrid or first filial generation would appear quite normal, behaving as such. In the second filial generation a quarter of the total number of mice might be sold as pure waltzers, though neither of their parents could be so described. And a third of the dominants of the same second filial generation might be certified as pure normals, though in each case the grandparent on one side of the house was a waltzer.

It may be noted that it is sometimes possible to distinguish the pure from the impure dominant externally, as is well illustrated by blue Andalusian fowls. When black and white Andalusian fowls are paired the resulting chickens show a finely divided pattern of black-and-white marking, which is called " blue." Black is dominant, D ; white is recessive, R ; and blue, D (R), is the impure dominant. If the blues are paired together, the average outcome per dozen chickens will be three blacks (DD), three whites (RR), and six blues D (R).

When the parents differ not in two contrasted characters, but in two pairs or three pairs, the resulting types will be more numerous, but the striking feature throughout is that the various dominant and recessive characters appear in successive generations in definite proportions and in their entirety or intactness. This is due to a segregation of the genes or factors in the germ-cells, for if there were 100 egg-cells, 50 of them would carry the dominant gene and 50 the recessive. The same is true of the sperm-cells, and fortuitous fertilisation of D or R egg-cells by D or R sperm-cells must yield the Mendelian ratio—1 DD + 2 D (R) + 1 RR, where only one pair of contrasted characters is concerned. Mendel had this idea of the segregation of the hereditary factors among the germ-cells of the hybrid D (R) generation, but he was naturally unaware of the fact, demonstrated by modern cytology, that the arrangement which secures this segregation is afforded by the reducing or meiotic division that occurs at the maturation of both egg-cells and sperm-cells, when the number of chromosomes in each unit is halved.

Before we leave this mere suggestion of one of the most important of modern biological discoveries, of equal theoretical and practical importance, we may notice, to avoid misunderstanding, that no one as yet understands why one of two contrasted characters should be dominant and the other recessive. The terms simply express the genetic fact that one of the two contrasted characters finds expression in the development of the offspring, while the other does not. There is no suggestion that the dominant character, which finds expression in the hybrid offspring (F.1), is stronger, older, more positive, or fitter than the recessive character, which remains latent or unexpressed. Another point is that Mendelian inheritance typically occurs when two contrasted true-breeding races or varieties or sub-species of *the same species* are paired. For the occurrence of fertile hybrids between related species is only occasional. It is typical of species that they are *not* fertile with related species, though not a few species-hybrids, *e.g.* mules, are well known.

Many biologists still recognise other modes of inheritance besides Mendelian, such as *blending*, as in " half-bred " sheep, the true-breeding result of crossing, say, Cheviots and Leicesters ; or *coarsely particulate*, as in a piebald pony ; or *reversionary*, as when a foal shows stripes on its withers ; or *complete hereditary resemblance* as in very pure-bred stocks where homogeneity prevails.[1]

Struggle and Selection

Darwin's conception of the struggle for existence was far ahead of that promulgated by many of his coadjutors, such as Huxley, and some of his disciples have strayed further than Huxley from the facts of Nature. For Darwin insisted that the phrase is to be used in " a wide and metaphorical sense," since the reality includes much more than life-and-death competition around the platter of subsistence. It includes efforts to baulk a callous environment and to secure for the family a good send-off in life ; it rises from cannibalism to an endeavour after well-being ; it extends to all the reactions that organisms make against environing difficulties and limitations.

Selection is a general term for all the sifting and winnowing that goes on in Nature, and few have realised its subtlety as Darwin did. It may be competition so keen that one variant with a plus novelty may kill another without it; or it may be between co-variants of the same species and a common enemy; or it may be entirely non-competitive, *e.g.* against an unfriendly environment. The selection may be *lethal*, when the issue is a quick or a slow killing off, the relatively fitter surviving; or it may be *reproductive*, when one type prevails in the course of time by having larger and more successful families than its rival or neighbour. What determines survival varies greatly from case to case. For the issue may depend on hardiness of constitution, on inconspicuousness, on swiftness of foot, on quickness of sense, on ability to utilise a long bill of fare, on capacity for winter-sleep, on nimble brains, on good digestion, on way-finding or homing, on fertility, on parental devotion, on beauty—and we need not continue the list. The important point is that the selection or sifting is in operation whenever and wherever the degree of survival and success depends upon the presence or absence of particular variations, which are possessed by some members of a species but not by others. A famine may reduce an animal population, say of lemmings, to a mere remnant, but it will not affect the character of the species unless the survivors survived in virtue of the possession of some particular qualities which were not shared by those eliminated, or not shared in the same degree. It is only *discriminate elimination* that counts.

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[1] The subject of Mendelian Inheritance is also discussed in the Article on *Sex*, p. 261

In the sifting that goes on in Nature the agent is the struggle for existence, and the sieve is the system of inter-relations—the web of life—in which the organisms in question are involved. Thus the sifting may be so penetrating that it eliminates and fosters in reference to characters which might be at first sight regarded as trivial. We might say that natural selection can separate those organisms which say Shibboleth from those that say Sibboleth.

Besides the many forms of natural selection, there is sex selection, where the sifting is in relation to reproductive success or preferential mating, and there are other forms, all operating in the same general way; the survivors surviving, the successful succeeding, because they differ in some particular feature from those that are eliminated. And there may even be survival value in *not* varying, as very conservative types, like the Lamp-Shell Lingula, the King-Crab and the Pearly Nautilus, well illustrate.

In domestication and cultivation man practises what Darwin called "Artificial Selection"; he works deliberately towards a desired end. But this cannot be said of natural selection, which goes on automatically. Yet it must be carefully noted that natural selection operates in reference to the already established *Systema Naturæ* and web of inter-relations, so that is far removed from fortuitousness. Moreover, various evolutionist thinkers, notably Professor James Ward, have pointed out—it is a very open secret—that living creatures often take a share in their own evolution by striving to make the most of their hereditary equipment in the given circumstances, or even by bending these circumstances to their will. This is part of the truth in Lamarckism, that the more vigorous animals always show something of the bent bow of endeavour. Organisms play their hand of hereditary cards for better or for worse, and thus, though they have neither ideals nor conceived purposes, they take a share in directing their own evolution. The picture of Organic Evolution as "a chapter of accidents" is an unwholesome caricature.

Isolation

As regards isolation, it is illustrated whenever there is a narrowing of the range of inter-crossing among the members of a species. It may be by a peninsula becoming an island or an archipelago, by a flood changing a river-bed, by a lava flow interposing a barrier, or by the development of an impassable stretch of desert-land. Or apart from such geographical isolations, there may be reproductive variations which establish among the members of a species differences in the time of sex-maturity, so that only similar forms can pair together. Or the same may result from variations in size and structure. Or there may be psychical preferences and antipathies which serve to narrow the range of inter-crossing. On the whole, inbreeding or endogamy tends to stabilise the characters of a species, while outbreeding or exogamy tends to promote an outcrop of new variations, two facts familiar to breeders, and often illustrated in human history. Close endogamy does not seem in itself to induce degeneracy, unless there are marked hereditary taints and defects in the inbreeding stock. In many cases a recessive Mendelian character of a minus kind, which is masked when there has been crossing of dominant-bearing and recessive-bearing individuals, is exposed by inbreeding, when two recessive-bearing individuals are more likely to pair. The outcrop of the deteriorative recessive characters is often referred to the evil influence of consanguineous unions as such, whereas it is really due to the conditions of Mendelian inheritance.

On many islands there are unique species, such as the St. Kilda Wren, the St. Kilda Mouse, the Fair Isle Mouse, and the Orkney Vole ; and one of the facts that most impressed Darwin on his famous Columbus voyage on the *Beagle*—discovering a new world, evolved and evolving—was seeing seven or so separate species of Giant Tortoise on as many islands of the Galapagos Archipelago. There can be little doubt that these separate species represent divergent offshoots from an original species which inhabited a great equatorial peninsula projecting from Central America into the Pacific. When a partial submergence of the peninsula resulted in an archipelago, variations emerged in the groups of tortoise on the various islands, and the fact of isolation assisted in the process of species-making. This view is corroborated by the fact that the Giant Tortoises do not voluntarily swim, and thus have a restricted breeding-range. This illustrates the isolation-factor in Organic Evolution.

In Conclusion

Three general considerations must be briefly alluded to in conclusion :—

(*a*) In spite of ourselves we tend to speak too often of past evolution, and too little of that which is at present going on. This is not unnatural, since the period under man's observation and record is so short compared with the hundreds of millions of years during which Organic Evolution has been in progress. Moreover, some types have long ago reached positions of well-established equilibrium, and do not seem to have varied much for ages, or to be varying in any marked way to-day. On the other hand, we have before our eyes the continued changefulness of domesticated animals—there is always some new dog on the market—and of the cultivated plants, as is evident in flower-shows, and in such exuberantly mutant forms as Lamarck's evening primrose, *Œnothera Lamarckiana*, which has been prolific in novelties. Outside man's shield, though under his scrutiny, there are some well-known mutating species like the fruit-fly, *Drosophila ampelophila*, which has in the twentieth century given rise to numerous true-breeding varieties. If these occurred in Wild Nature they would be regarded as new species. They are possible species in the making. It is not very long since some long-tailed field mice (*Apodemus* or *Mus sylvaticus*) were accidentally marooned on Fair Isle, one of the Shetlands, and there establishing themselves, gave rise in the course of generations to a new species, *Apodemus fridariensis*. Within recent years, the story has repeated itself, for some Fair Isle mice were taken by chance to the Ultima Thule of Tacitus, the island of Foula, some twenty miles out into the Atlantic, and have there by further variation given rise to a new variety, *Apodemus fridariensis thuleo*, which may, by continued divergence and stabilising, become clearly worthy of a new specific name. For approximately stable varieties are new species in the making. It is a question of degree. The important fact is that *evolution is going on*.

(*b*) In the minds of some loose thinkers, especially of anti-evolutionist prejudice, there lingers an erroneous view of the origin of species which is often expressed in the criticism that no naturalist has ever seen one species of plant or animal turn into another. It might be replied that brusque mutants occur which are at a leap as different from their parents as are many instances of related species ; or it might be pointed out that the mills of organic evolution grind very slowly ; but the final answer is that the critics are looking for a phenomenon which the evolutionist has not even imagined. What has happened, and still happens, in the origin of a new species is that a number of similar variants diverge from the parent stock, breed together, attain specific stability, and find a footing in the struggle for existence, often in some slightly novel niche of opportunity. If their novel features are very markedly advantageous as compared with those of the originative stock, the new may oust the old ; or as often happens, the old and the new may get along together, probably with some slight difference in habits and habitat. But one species does not turn into another ; that would be magic, not evolution !

(*c*) The origin of well-marked newnesses is the most striking feature in evolution and the crowning wonder of life. We refer especially to great steps, such as the origin of birds from an extinct reptilian stock, or the origin of warmbloodedness or viviparity, or the origin of tentative men. In these new departures and in many others more or less comparable in magnitude, the step is in kind rather than in degree. We cannot but feel that what appears is too big for its premises ; it is certainly more than the additive result of its antecedents. This is expressed by calling it a new synthesis, a new " whole," an " emergence." The terms do not explain anything, but they lay useful emphasis on the fact that many of the great novelties that have successively arisen in the course of the ascent of life are disclosures of some new aspect of reality which could hardly have been anticipated. Even below the level of the living there are some good illustrations of emergence, and one of the best is water. From a union of two gases—hydrogen and oxygen—there emerges liquid water, an unpredictable novelty with remarkable properties of far-reaching importance, making the whole world new. At the other end of the scale, the appearance of man, though implying a slow dawn, was an emergence, for man's reason is a power very different from intelligence, which he shares with the higher animals, and man's language is very different from animal speech. The story of Organic Evolution shows a succession of creative emergences.

The " man in the street " has often a philosophy—an attempt to think of all things together, and this colours his life. In the philosophic or synoptic picture a large place must be found for Organic Evolution ; and it is therefore very important that everyone should have a clear vision of the actual facts, which are often travestied in careless exposition. Even the expert philosophers are sometimes open to the reproach of dealing with worn clichés of Nature, instead of with the facts themselves. Thus it is seldom recognised that the evolution of Animate Nature shows trends towards human ideals. In Wild Nature there is almost no disease ; Organic Evolution makes for health. Animate Nature also favours that mastery of natural energies—a food store as its simplest—which allows of a certain freedom of action and victory over vicissitudes. Organic Evolution makes for wealth. But if health and wealth be regarded as no more than pre-conditions of man's true progress, which is a balanced all-round movement towards a fuller realisation of the true, the beautiful and the good, the biologist can advance his position and maintain that there are in Organic Evolution great trends towards even the highest values. Thus Beauty is almost omnipresent ; the success of Birds and Mammals is a testimony to the survival values of the raw materials of morals ; the largest fact in Organic Evolution is the growing emancipation of Mind, and many are the rewards that have gone to clear-minded as well as able-bodied animals. Part of the momentum of Organic Evolution works in Man to-day, and while we always hope that the ape and tiger may die within us, we are not perhaps sufficiently appreciative of other pre-human legacies which are in line with our best endeavours.

Finally, it is often and rightly said, as we have just been suggesting, that Man must be considered in the light of Organic Evolution, the outcome of an age-long process—and also a promise. But we must also envisage Organic Evolution in the light of man, since it is in Man that Nature finds its chief significance. We might say, *Finis coronat opus* ; were we not reluctant to think of any full stop to the evolutionary process as a whole.

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SEX

By

F. A. E. CREW

SYNOPSIS

Is there a better definition of sex than that of Plato, which suggested that in the beginning man and woman were one but that through the wrath of the gods they were cleft apart, only ceaselessly to strive thereafter to come together again ? Even though we cannot define sex exactly, we can describe its manifestations. Is sexuality only to be understood and justified by reference to its relation to reproduction ? Can we dissociate the two and study them apart ? We can, and we can conclude that the attitude which demands that sex shall be the servant of reproduction cannot honestly find support in an appeal to biological fact.

How and when is the sex of the individual determined ? The sex-determining mechanism has been laid bare, and the precision of its workings revealed. We know that sex is determined at the time of fertilisation by the mechanism which governs the distribution of the sex-chromosomes. But we know, further, that this mechanism in many forms can be and is influenced, even overwhelmed, by the impress of other agencies. Just as in controlled experiment, male can be transformed into female and female into male, so also under certain conditions sex-inversion can proceed in nature. The rôle of the sex-hormones in this strange reversal of sexual destiny is even now fairly clearly understood, and our present knowledge permits us to envisage a future in which many forms of personal and social disharmony will be repaired by means of the therapeutic use of these most potent modellers not only of the body but also of the mind, for already it can be shown that many of the problems of the psychologist need for their solution an appreciation of the facts of the newer physiology and biochemistry.

More boys than girls are born : among people eighty years of age and over there are twice as many women as men. It would seem that far more male children than female are conceived, and that both before and after birth the male dies far more easily than does the female. What is the explanation of these and allied facts ? How might the sex-ratio be controlled ?

SEX

THE NATURE OF SEX

Sex, in its manifold manifestations, is so intimately woven into the fabric of human life that anyone, be he scientist or layman, must approach its study with awakened interest. When once the mind becomes entangled with the problems, personal and social, which cluster around sex, then, inevitably, insistent wonder and curiosity are aroused to yield in their turn, all too commonly, it would seem, myth and legend, taboo and doctrine. In every generation and in every land the complex of sex has been, and still is, regarded as one of the outstanding problems of the day. With passing time the problem has remained unchanged, but the attitude of peoples toward it has varied. In some societies an interest in matters pertaining to sex has been openly admitted; in others it has been anxiously and imperfectly concealed. To-day and in most countries it is no longer accepted that sex is one of the great mysteries that defy understanding, and the recognition of the fact that its peculiar mechanisms are complicated merely stimulates enquiry and no longer inhibits effortful analysis. The point of view is gaining ground that sex is a matter to be examined and explained.

Science, which has enabled man to know the laws which govern the movements of molecules and the mechanisms which drive the world on toward its destiny, has also taught him that he may think of himself, with all his lusts and pains, his doings and his dreams, his beginning and his ending, as the expressions of physico-chemical forces ; even though, beyond and above all these, something other and additional may exist. It is this attitude of mind which has encouraged man to tear aside the veils which have concealed the problem of sex, and thus to learn that in all probability all expressions of sex are nothing more or less than the results of the workings of a knowable, analysable, chemical mechanism. We know that male can be transformed into female : female into male ; that those details of structure which distinguish the sexes can be destroyed and as easily restored. We know a great deal of the manner in which, and of the time at which, sex is determined in the life history of the individual, and that the mechanisms involved in this process can be manipulated to an extent far beyond the imagination of those who are unacquainted with recent developments in this field. That we know these things and more is due to the fact that sex—an attribute of the living organism—has become a proper study for the biologist who, unlike the layman, does not regard sex as an exclusively human affair. To him, sex in man is only one instance of a phenomenon which is to be encountered in countless other forms of life. That we know already a little about ourselves is due to the fact that we have learned a lot about other forms. The reader who prefers to hold the view that man is surprisingly different from mouse or microbe in respect of the fundamental phenomena of life must not expect t glean much from the writings of a biologist. The comparative method is universally employed in scientific enquiry, and biology has ever assumed that such phenomena as natality, mortality, sexuality and reproduction, for example, are not the peculiar possessions of any one particular species, but are the attributes of living things in general.

To the layman, unacquainted with the more recently disclosed facts, nothing could appear simpler than to define sex by stating that there are two sexes—male and female; that male differs from female in that he provides one kind of germ-cell, the spermatozoon (Gk. *sperma*=seed, *zoon*=animal), she another kind, the ovum or egg, and that, associated with this main difference, there are others which permit the observer to tell at a glance whether any given individual belongs to one sex or to the other. It is the case that one can classify the individuals of those forms of life with which the layman is acquainted as males and females, but when one undertakes a survey of the multitude of different forms of animal and plant life one finds that the distinguishing features quickly disappear. Yet, though in many forms the sexes can no longer be distinguished, it can be shown that amongst these there is still sex. What, then, is sex? The layman may perhaps find an answer, but no biologist has yet given a sufficiently comprehensive and satisfactory reply. We do not know what sex is. Biology has not yet reached that stage of its development when it can describe the objects of its searchings. To one who is acquainted with the history of the sciences this is not surprising, for it will be found that the nature of the subject of scientific enquiry is commonly the last thing to be discovered. The physicist writes easily of matter, but he is not able to state what matter is. The biologist speaks easily about sex, yet he does not know what sex is. For the present, he disregards this fact and busies himself legitimately with a description and a consideration of the varied expressions of certain phenomena which are regarded by him as pertaining to the sex-equipment of the individual.

One need not travel far in order to prove to oneself that superficial structural differences in characterisation are not satisfactory criteria for identifying the sex of an individual. The cock can be distinguished easily from the hen of a domestic fowl; to distinguish the drake from the duck of many of the self-coloured domesticated breeds is not so simple; whilst to distinguish the gander from the goose requires the knowledge of an expert breeder. And if one passes from the bird to the fish and onwards in a survey of the simpler forms of life, one at once finds that in countless forms in which sex exists there is no ready means of distinguishing male from female. So that, whatever sex may be, it does not demand the existence of two types of individuals, readily distinguishable one from the other by differences in their superficial characterisations.

In many of the forms in which male is not to be distinguished from female by differences in form or adornment, the sex of the individual can be recognised by reference to the rôle that the individual plays in the act of sexual congress. In man and in domesticated animals generally the male, during the sexual act, deposits the spermatozoa elaborated in his testes within the genital tract of the female. But reference to other forms shows that mating does not necessarily demand the intimate congress of two bodies. In the case of certain newts, the male deposits a gelatinous capsule containing his spermatozoa on the bottom of the river or of the aquarium, and the female then takes this up within her vaginal orifice. There is a small cuttlefish in which the semen of the male is passed into a transformed arm, which then breaks away and makes its way through the water until it meets a female of the species, into whose body it passes. In all these cases, mating involves the transference of spermatozoa elaborated by special organs—the testes—within the body of the male to the genital tract of the female. But, in other forms, mating is concerned with the transference of material which cannot be regarded as being either a part of the sex equipment of the individual or a product thereof. The slipper animalculæ, Paramæcium, for example, which is a minute, single-celled organism that lives in stagnant fresh-water pools, mates by forming a temporary union with another individual, quite indistinguishable from itself, by means of a bridge of living matter or protoplasm (Gk. *protos*=first; *plasma*=form). Across this bridge nuclear material is exchanged, and thereafter the individuals separate again. In other forms, mating consists in the complete and permanent fusion of two complete individuals to form one.

It is difficult to trace a common feature through all these instances of mating. In the lowest forms it involves the permanent union of two whole individuals. Next comes the transient union of whole bodies and the interchange of bodily material. Thereafter comes the relegation of the task of providing the sexual contribution to special organs of the body. Associated with this are refinements in the mechanisms, by means of which the spermatozoa are transferred into the genital passage of the female. These make fertilisation of the ova by the spermatozoa more certain. This being so, the opportunity for practising economy in the production of ova is provided. Many fish, for example, extrude millions of ova during the breeding season, but, since fertilisation occurs in the water when ova chance to meet the spermatozoa extruded by the male, the majority are never fertilised. In the mammal, on the other hand, the spermatozoa are deposited in the genital tract of the female, and fertilisation is practically certain. It is a matter of interest to note that such economy is practised only by the female. The male, during the act of sexual congress, provides enough spermatozoa to fertilise millions of ova, yet commonly only one ovum is available for fertilisation. The variety in the matter of mating amongst the different species is such as to make it impossible to derive any general principle from a comparative study. The sex of an individual cannot be identified by reference to the rôle played by that individual during sexual congress.

It would seem that one is almost driven to the view, that the nature and meaning of sex can only be recognised by bringing it into a definite and essential relation with reproduction. Society and the needs which have had their origin in the peculiarities of its structure have indeed always demanded that sex and reproduction shall not only be related one to the other in their actual expression, but also that sex can only be understood and justified by postulating that it is the mechanism which Nature has ever used for the preservation of the species and for the improvement of the race. It will be found that in most biological text-books, " reproduction " is the title of the chapter which includes a subordinated account f sex. Morals, as determined by recent forms of civilisation and as taught y cleric and philosopher, unhesitatingly state that sex is the servant of eproduction ; the means whereby Nature achieves the continuity of the pecies ; the reward which Nature pays to the individual for fulfilling its uty in begetting its kind. Schopenhauer, the great German philosopher, ho was the first to express clearly the argument that love and sex are othing but mechanisms which Nature created for the purposes of serving eproduction, held the view that the attraction which two individuals feel or each other is to be explained only by reference to a purpose, and could est be understood as the working of a mechanism devised by Nature for he drawing together of those individuals suitably matched for reproduc-ion. Such views as this impressed and even guided biological thought for enerations. It is to be noted that they are not contributions of the science tself, but impositions born of sociological necessity or of theological pre-erence. They have had a definitely degrading influence upon the logical tructure of biology, and far too few biologists have rebelled against this nterference of social and theological demands in the development of their wn particular science.

It is too commonly forgotten, that the scientist of to-day does not con-ern himself with the meaning and the purpose of things. Until he leaves cience for philosophy, he is not interested in the great generalisations hich gripped the minds of men in older days, and which began with ‘ why ” and asked for final solutions. He does not seek ultimate truth, ut only an understanding of the mechanisms which underlie the pheno-ena of life and the attributes of living and non-living things. He has not o much interest in the purposes of creation as in the methods by which hey may have been achieved.

It can be understood how Schopenhauer's authoritative teaching would e welcomed by such as sought an endorsement of the common demand, hat in any society wherein population increase is to be desired for any eason, everything that encourages a high birth-rate is praiseworthy and hould be rewarded, whilst anything that tends to reduce the birth-rate s blameworthy and should be punished. Under such conditions sexual ntercourse without pregnancy as a sequel must be avoided, and in order o discourage unfruitful intercourse the people must be taught that such s unpatriotic, even sinful. Furthermore, it would seem that in every ociety there have been and are sufficient biologists of position, who will rovide endorsement for such attitudes by an appeal to what they regard s legitimate interpretation of scientific fact. In the past the biologist has ustified feudalism, Manchester Liberalism, socialism, and every other ype of social organisation and political programme by reference to elected biological phenomena, and they who have shown that it is not nly right, but even natural, that the strong should devour the weak, can ave no difficulty in accepting from the non-biologist the view that sex s but the servant of reproduction.

Without doubt, the chief reason for the prevalence of this point of view s the might of the impact of Jewish theology upon the sex-ethic of other eoples. It is of interest, however, to note that there have been peoples, uch as the aborigines of Australia and the inhabitants of the South Sea slands, who have been entirely unaware of the connection between sexual intercourse and reproduction. To these fertility was the gift of a spirit, and mating, which was bound up in many rites and customs, had nothing whatsoever to do with parentage.[1] To other peoples, the Greeks, for example, sex has been justified simply and completely by sexual desire, and has been explained by reference to its nature and not to its apparent purpose. It is seen, then, that the point of view exhibited by many societies has not been universally accepted ; and, in any case, it can be argued that the reasons which have persuaded such societies to the view that sexuality can only be justified by reference to reproduction are not themselves scientific. Of course this does not prove that the attitude itself is necessarily unsound. But when the matter is considered dispassionately, it will be found that it is impossible to endorse it by an honest appeal to scientific fact. It is true that sexual activity commonly precedes, leads up to, and passes on to reproductive activity, but the relationship of sexuality and reproduction is such that one can as readily argue that the purpose of reproduction is the replacement of sexual individuals as to argue that the purpose of sexuality is to make reproduction possible. If the sexual act leads to reproduction, then reproduction itself yields nothing but another sexual individual. Reproduction leads to sexuality just as much as sexuality ends in reproduction. Birth leads to birth, and so there is a continuous cycle with no beginning and no end, neither purpose nor cause.

This statement, however, is but a formal and logical one, and is not enough. It merely argues that the explanation of sex as a means of reproduction is not valid. It does not obviate the necessity of analysing the obvious interrelationship of sexuality and reproduction which undoubtedly exists. Even the slightest acquaintance with this subject shows that the relationship is so intricate and intimate, that it may well be doubted that any attempt at the analysis of this complex can be successful Nevertheless, the point of view that such an analysis is both desirable and possible must prevail. It is true that the time has not yet arrived when a final answer to the question as to what sex actually is can be given ; the present is but the period of preliminary analysis in the science of sex biology. For the time being, we must concern ourselves with a description of the object of this science and with a survey of its particular field, and it is to be recognised that, as knowledge increases, complications will arise which will demand revision of most, if not all, of the conclusions at which we may now arrive. In the development of any science, advance, in the first stages rapid, becomes retarded as the probings become deeper.

It is desirable to examine the question of the possible separation of sex and reproduction for the reason that unless they can be so separated neither can be analysed alone, with the result that much concerning them separate and in association, cannot be understood. That they *can* be separated can be shown by an appeal to the comparative method of study If we were to confine our attention to one species, then the task would be impossible, but if we compare sexuality and reproduction in the different species, and if we assume that all these possess certain attributes in common, our task becomes quite hopeful.

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[1] For an elaboration of this point, see the Article on *The Beginnings of Morals and Culture*, p. 413.

A review of sexuality in its various aspects, and as exhibited by the nany diverse living forms, reveals the fact that it is indeed usually asociated in the most intimate fashion with reproduction. This is especially o if one's survey is restricted to the higher animals. But if it is extended o as to include invertebrate animals, plants and the unicellular organisms, ne finds, amongst these, innumerable instances of reproduction without ex ; in other words, that asexual reproduction—the production of offpring without mating—is as widespread as is reproduction with mating. Manifestly, therefore, sexuality is not essential for reproduction. The ndian stick insect, Dixippus, exists both in the male and female form, ut the male is exceedingly rare and the mating of male and female has ever been observed. The female lays a great number of eggs which evelop without having been fertilised, and in this insect the male is to e regarded as a reminiscence of older times in the history of the species, hen both sexes played their rôle in mating and when fertilisation was he rule.

It has long been known that the eggs of the sea urchin, which normally egin their development only after having been fertilised by the spermaozoa of the male, can be made to develop by being placed in sea-water, he salt concentration of which is higher than normal. Furthermore, it as been demonstrated that if the egg of the frog is punctured by means f a fine needle, it will develop into a tadpole and thence into a frog, hough usually, before there can be reproduction, the ova of the female ust be fertilised by the spermatozoa of the male. A " fatherless " frog as been produced, but as yet no fatherless mammal has appeared under onditions of controlled experiment. That this is so is not surprising, for here are so very many difficulties in the way ; the egg of the mammal is tiny and is so jealously guarded within the body of the mother. Examiation of large numbers of ovaries of rats, however, has shown that in all robability unfertilised eggs begin to develop into embryos, and although is development does not proceed very far, nevertheless such instances learly demonstrate that, in principle, the origin of a new individual in e rat can occur in the absence of any influence contributed normally by e sperm of the male. Since this is so, it follows that the production of ffspring by the mammal, though usually intimately associated with exuality, is not necessarily dependent upon it.

The architectural unit of the body is the cell. This is a minute mass of ving stuff—the so-called protoplasm, enclosed (in most cases) within capsule or wall. There are two kinds of living things—the unicellular rganisms, whose bodies consist of a single cell, and the multicellular, hose bodies consist of many cells. In the latter, different groups of cells re concerned with different functions. One group constitutes the reroductive organs which elaborate the sex cells. If one examines a typical ell one finds that the protoplasm within is not homogeneous, but that y appropriate methods of staining this by means of dyestuffs it is possible distinguish a central area—the so-called nucleus—which can be shown differ chemically, and structurally, from the rest.

If one turns to the unicellular or noncellular forms of life, the rotista (Gk. *protistos*=first of all), the primitive organisms from which nimals and plants arose, one can readily find evidence which seems to show that amongst these sexuality and reproduction are not only distinct but are contrasted. They reproduce or multiply by a process of simple division : one individual dividing to become two. On the other hand, two individuals may fuse—conjugate—(and it is customary to regard this conjugation as a sexual process) and the result of this fusion is that the number of individuals is reduced and not increased. So also it is in the case of the human subject ; the origin of a new individual occurs in the union of two sex-cells to become one—the ovum and the spermatozoa, the gametes or marrying cells (Gk. *gametes*=spouse) fusing to form the zygote or fertilised egg, which by its continued division gives rise to the new individual. The process of building the new individual out of the fertilised egg is asexual, being nothing more than the continued division of cells, all having their origin in a single cell. It would seem, indeed, that the part that sexuality plays is merely that of providing the stimulus to this cell division. Normally this stimulus takes the form of the fertilisation of the ovum by the sperm, but as has been shown, this fertilisation can efficiently be replaced by relatively simple physico-chemical techniques.

There is no difficulty in showing, therefore, by an appeal to the facts of biology, that sexuality is not the only means of reproduction. Reproduction can occur without sexuality. It follows that one cannot argue that sex is, in all cases, the servant of reproduction. Still, one might argue that sexuality is necessary for reproduction in those forms in which it has been developed and in which sexual activity normally precedes reproductive activity. It has been urged that the fact that sexual reproduction is so common amongst the higher forms is an indication that it must be positively advantageous to its exhibitors. It is assumed that the higher forms possess greater efficiency in their functioning than do the lower.

But surely we have the right to ask those who compare one mechanism with another to define and to exhibit their standards ! By what yardstick are the modes of reproduction to be measured ? It used to be taught that sexual reproduction was more advantageous than asexual, for the reason that the union of cells derived from different bodies leads to rejuvenation. It is the case that the germ cells of the higher plants and animals perish unless they unite in fertilisation ; but it does not follow that senescence and natural death are fundamental phenomena inherent in all living tissues, or that conjugation (*i.e.* the temporary or permanent fusion of two individuals) and fertilisation (*i.e.* the fusion of two dissimilar sex-cells, sperm and ovum) are the only means of outwitting them. It is known that in many animals parthenogenesis (the process whereby an egg develops without activation by a sperm) can replace fertilisation as a method of reproduction, either temporarily or else permanently. Moreover, experiments involving the growth of cells outside the body on appropriate media, and of tumour cells transplanted from individual to individual have shown that these can thrive indefinitely. It is abundantly established beyond all doubt that the living cell can multiply and flourish in the absence of any sexual reinforcement. Many are the cultivated plants which have been propagated continuously by root cuttings or grafts for long periods of time, and yet show no signs of diminished vigour. In fact, there are certain plant species which are completely sterile and which reproduce xclusively by parthenogenesis (Gk. *parthenos*=virgin; *genesis*=descent) r by some other asexual process.

The conclusion that conjugation or fertilisation, with the resulting nixture of living contributions from two sources, implies rejuvenation vas reached from the study of conjugation in noncellular organisms. The lipper animalculæ, Paramæcium, multiplies, as has been stated, by diviion of the individual into two. As soon as these daughter individuals iave reached full size they divide again. Normally, however, there occurs, fter a series of such divisions, a phase when this multiplication is replaced y conjugation. It was observed that as the age of a culture of Paramæcium ncreased, the frequency with which multiplication occurred became teadily reduced; and that after the period of conjugation the division ate again reached its full height. It was assumed, therefore, that coninued asexual reproduction, as represented by division, could not go on vithout end, since the periods of such multiplication were followed by eriods of physiological depression and then by the death of the culture nless conjugation occurred. Conjugation, it was concluded, removed the esults of this progressive diminution in vigour. However, it has more ecently been shown beyond all doubt that such degeneration of the stock an be due simply to faulty husbandry, and that the conclusion that conugation was responsible for the rejuvenation of the culture is no longer enable.

Other somewhat similar theories, formerly very prominent in biological eaching and all concerned with the nature and meaning of sex, have assed into obscurity. One of the most prominent of these was that conerning amphimixis (Gk. *amphi*=both; *mixis*=mingling)—the mingling f maternal and paternal contributions to the offspring in the fusion of wo dissimilar individuals or gametes. This theory had its origin in the xperience of breeders who had noted that crosses between different races, arieties and species, were often remarkable for their vigour, this comionly taking the form of a greater size, more luxuriant growth, earlier ttainment of maturity, or greater resistance to unfavourable external onditions. The results of the early hybridisers gave rise to a widespread elief, that this crossing was itself the cause of this increased vigour, and hat inbreeding—the mating of near relatives—was in the same sense the ause of degeneracy. It is now known that outcrossing, which involves he mating of two dissimilar types, does not invariably yield hybrid igour, and also that inbreeding is not always harmful but that, in fact, t can be definitely advantageous, leading to the establishment of a uniorm and true-breeding stock. For an understanding of the modern inerpretation of the facts concerning these estimates of breeding, a certain cquaintance with Mendelian theory is demanded.

If the nucleus of a typical cell is examined it is found to consist of nasses of material which take up stain eagerly and deeply and which is nown as chromatin. In certain stages of the process whereby a cell divides o become two, this chromatin becomes aggregated in the form of rods —the so-called chromosomes. Modern Mendelism postulates that correponding to all of the hereditary characters (details of form and of funcon) which an individual may exhibit, there are hereditary factors resient in the chromosomes. Hereditary characters can be classed in pairs and the members of each pair are alternative. For example, the colour of the eye in man may be brown or else it may be blue. In respect of each character exhibited by the individual there are, in the cells of the body and in the unripe germ cells, spermatozoa or ova, two hereditary factors, one of which was derived from the paternal parent, the other from the maternal. Thus a particular individual may have received the factor for brown eye colour from both parents and thus be duplex for this factor, and homozygous (Gk. *homos*=same; *zygon*=yoke) for the character responding to them. An individual, on the other hand, may have received the factor for blue eyes from each of its parents, and therefore be simplex for the factor and homozygous for the character blue eye colour. But an individual which has received the factor for brown eye colour from one parent and the factor for blue eye colour from the other will be brown-eyed and it will be heterozygous (Gk. *heteros*=other; *zygon*=yoke), or hybrid, for the character it exhibits. In order to express this fact that when the factors for brown and blue are both present, the brown character prevails, brown is said to be dominant to blue and blue recessive to brown.

The individual carries the hereditary factors in pairs, and in the case of each pair the members may be alike or unlike. But, into the ripe gamete there passes only one member of each pair of factors. Thus, in respect of all the factors for which the individual is duplex, the gametes will all be alike, but in respect of those factors for which the individual is simplex there will be two kinds of gametes, those with this factor and those without it. Thus it is that the individual "breeds true" for those characters for which it is homozygous.

It is assumed that inbreeding has but one demonstrable effect : it increases the degree of homozygosity, that is, the state of being homozygous for the characters exhibited by the stock, and duplex in respect of the factors corresponding to these. An individual is to be regarded as a combination of many thousands of hereditary characters, and probably in respect of most of them it is heterozygous. Inbreeding reduces this hybridity, and slowly but surely leads to a state in which the individual is homozygous for all the characters it exhibits. But all characters are not advantageous. In every one there are the hereditary factors which correspond to characters that maim and deform and kill. But since these are for the most part recessive in nature, the alternative normality being dominant in relation to them, they are hidden and do not work their will in the case of individuals which are heterozygous in respect of the characters corresponding to them. Only when an individual which is homozygous for such a character appears is the effect seen. Inbreeding provides the opportunity for such an individual to appear. Outcrossing reduces the chances of such an individual appearing, since it is unlikely that two comparatively unrelated individuals will be carrying, hidden in their hereditary constitutions, the factor for the same deleterious character. But just as inbreeding permits the appearance of undesirable characters, so does it also lead to the production of individuals which are homozygous for the useful, advantageous characters, and since the great merit of homozygosity is that its possessor breeds true, therefore, through inbreeding, there can arise a stock purged of its undesirable recessives and n virtue of its hereditary constitution, inevitably begetting offspring as iomozygous and therefore as excellent as itself. Outcrossing, on the other iand, increases the heterozygosity of a stock. The good characters of one arent can reinforce the good of the other. The harmful recessives of one an be covered by the alternative advantageous dominants of the other. But hybrid vigour only follows when the contributions of the two parent re complementary and compensatory ; profound disharmony can ensue vhen undesirable reinforces undesirable. It is because two comparatively nrelated individuals are less likely to carry the hereditary factors for the ame deleterious recessive characters than are two comparatively closely elated individuals, that sexual reproduction, associated with marriage aws that prevent the mating of close relatives, can perhaps be preferred o asexual methods of begetting offspring. But the advantages of sexual eproduction are not inherent in this particular system. The effects are eferable to the peculiarities of the hereditary constitutions of the indivi- luals that mate.

It has been argued that this amphimixis has played a most important ôle in evolution. New hereditary characters, advantageous or harmful, ave their origin in an alteration in the hereditary constitution, that is, n the hereditary factors of the individual. Such an alteration is known s a mutation. In sexual reproduction such a mutation can have occurred n either of the two parents, and so mutations occurring independently n time and space can meet. This is not so, of course, in cases of asexual eproduction, for here there can be no pooling of advantageous mutations hat have been endured by two individuals. A further advantage of sexual eproduction is that, by the pooling of the characters of two parents, off- pring combining the advantages of both can be produced.

It is a matter of observation, however, that the majority of mutations vould seem to be disadvantageous. In the case of asexually reproducing orms, such mutations would either eliminate or seriously embarrass their xhibitors. In sexually reproducing forms, on the other hand, such re- essives could remain hidden for long periods and only be brought to ght amongst the offspring of two individuals, each of which is hetero- ygous in respect of these characters. Thus a stock in which sexual re- roduction is the rule could become slowly but surely loaded with harmful ecessives, which almost certainly must lead ultimately to the appearance f degeneracy. Under such circumstances racial decay is inevitable. In ontrast with this, the elimination of the unfit, in the case of the asexually eproducing forms, is swift and ruthless. Moreover, homozygosity in re- pect of advantageous characters can only be obtained if sexual repro- uction is the rule and, in the absence of definitely controlled mating, fter a very considerable time. In the case of the asexually reproducing orms, the state of homozygosity is attained relatively quickly, and once has been achieved it continues.

It may be argued that heterozygosity implies a power of adaptation on ie part of the individual to a changing environment. It seems to be the ase that the homozygous individual is not relatively so plastic. This may e a matter of considerable importance in the case of other forms, but ian can control his environment much more easily than he can control is hereditary constitution. It is far simpler to warm a room than to impose a control upon one's own temperature-regulating mechanism. Moreover, how can one maintain that the lowly bacteria cannot and do not adapt themselves to changing environments ? Indeed, they are remarkable for their powers of adaptation, and yet they reproduce asexually. It is interesting to note that if mankind reproduced asexually, then racial improvement would be a simple matter, if only certain selected individuals were permitted to reproduce themselves. Heterozygosity associated with sexual reproduction certainly yields fascinating variety in the matter of combinations of hereditary characters, but the association certainly prevents the easy perpetuation of the desirable and permits the appearance of the definitely undesirable, judged by any standard, in increasing numbers.

An examination of the postulated intimate connection between sexuality and reproduction, then, fails to demonstrate that such a connection exists in fact. Furthermore, sexuality does not seem to possess any real advantage over asexuality in the matter of reproduction.

It would seem that the personal value of the sexual act is not necessarily reduced after sterilisation. The " change of life " or menopause in womer marks the cessation of those activities on the part of the ovaries whicl lead to the production of ova, but though reproduction thereafter becomes impossible, the personal enjoyment in sexual congress is not necessarily thereby decreased. In the case of the male, castration in the adul is not followed by an inability to perform the sexual act, though certainly it renders fertilisation impossible. It can be shown that sexual activit without reproductive activity is as possible as reproduction without sex In the case of the man, the sexual act is the reproductive act : it is th actual ejaculation of the seminal fluid which gives the greatest sense c pleasure in the sexual act, and this ejaculate is the contribution of th male to reproduction. To prevent ejaculation is to avoid satisfaction : t avoid the reproductive act is to obliterate much of the sexual act. But i the case of the female the sexual act has nothing whatsoever to do wit the reproductive act, for coitus is not attended by the discharge of ova In her case sexual satisfaction is achieved through the stimulation c nerve endings in the genital tract by the copulatory organ of the male and ovulation—the discharge of ova from the ovaries—does not occu until some hours later, as in the rabbit, or else it has no relationship whatsoever to coitus. In the human female, ovulation occurs periodically an unconsciously during the period puberty-menopause, both in wife an in virgin, and coitus has nothing whatever to do with this process. Ther is no reason for assuming that the extrusion of an ovum is in any wa a conscious or a pleasurable event. The pleasure of sexual activity has n relation to reproduction. It is present whether coitus is fruitful or abortiv

It may be argued that sexual activity is really associated with reproductive activity in the human female for the reason that sexual activit is associated with the reception, if not with the extrusion, of gametes. Bu such a contention cannot be maintained. Masturbation can replace coitu and it can be shown that sexual satisfaction on the part of the female not necessarily attended by the reception of the gametes of the male. Th only possible relation would seem to be that sexual activity in the femal permits her to exhibit her reproductive function.

The search for a definition of sex would seem to be hopeless. It has been shown that one cannot refer it to the relationship of two individuals, these being either dissimilar or similar in characterisation. It is true that in the case of man and of domesticated animals the sexual act is an *affaire à deux* in which two dissimilar individuals, a male and a female, play different rôles. But this is not all, for following intercourse there is a definitely sexual interaction between the gametes, the ovum and the sperm. These are as dissimilar in their form and function as are the bodies which elaborate them. There is thus a sexuality of the individual and also a sexuality of the gamete. It is the case that usually the sex of the individual is in accord with the sex of the gamete elaborated by that individual, but it can be shown that the sexual characters of the individual are not dependent upon the type of gametes which the individual elaborates. Experimentation has shown that the general appearance and behaviour commonly regarded as typical of maleness are exhibited even in cases in which the tissue of the testis, which is responsible for the production of spermatozoa, has been destroyed, and similarly that the typical female characters persist after the production of ova by the ovaries has been rendered impossible. The production of spermatozoa is only one of the characters which, in their combination, comprise the state or quality of maleness ; it is not the cause of maleness ; and therefore the sexuality of the gamete and the sexuality of the individual must be considered separately.

Biologists have applied the term " sexual activity " to so very many and such varied phenomena, that any exact definition is difficult. However, there would seem to be general agreement that sexual activity is that particular activity exhibited in the mating of male and female, being the force which impels the individuals to mate. But, as has been said, the modes and methods of mating are exceedingly varied. In certain forms male and female do not exhibit any mutual activity in mating. Each, apparently without reference to the other, merely extrudes its gametes and these, disseminated through the water, meet and mate, that is to say, that dissimilar gametes mate but that sexual individuals do not. Now, such a meeting and mating of gametes is just as much a sexual act as is the meeting and mating of male and female individuals. Manifestly, the mating of individuals cannot be a criterion of sexuality. It has been shown that sex-dimorphism—the existence of structurally different male and female forms within a species—is not, as would appear to be the case at first sight, fundamental to sex. There are no sexes in the common earth worm or in the common snail. All individuals are alike in respect of sex-equipment, each possessing both ovaries and testes, and each producing both ova and spermatozoa. Nevertheless, the individual does exhibit sexual activity for, having reached a certain stage of its development, each seeks out a mate—another individual exactly like unto itself—and the two join in sexual intercourse, each fertilising the other. In forms such as this one cannot speak of the mating of the sexes, but only of the mating of two individuals. It is even more difficult to fit into the conventional picture of sex forms such as Spirogyra. This is a plant which has the form of long green threads, anchored to the bottom of ponds and slowly flowing streams. Every thread is subdivided into many component cells, and should two such threads come together after they have reached a certain stage in development, it may be seen that some of the cells send out protruding feelers which enter cells of the adjoining thread. Moreover, it is possible to distinguish between the passive cell which receives the feeler and the active cell which sends these out. One might refer to the passive cell as being the female and its mate as the male cell in this relationship. By experiment one can distinguish between threads, all the cells of which under these conditions extrude feelers, and other threads, all the cells of which receive these ; that is, one can distinguish between male threads and female threads. But should one keep two female threads together, one or other of them will behave as a male toward its companion. The explanation offered to accommodate these and other facts is that these threads are weakly or strongly sexed. A " weak " male behaves like a female in its relationship with a " strong " male, or as a male to another male " weaker " than itself. Manifestly, the meaning of maleness and femaleness loses much of its clarity. The relationship of thread and thread can better be understood if one merely states that the strength of the sex of these threads varies and that the more strongly sexed thread behaves as a male toward the weaker sexed thread, and that the weaker sexed thread behaves as a female toward the more strongly sexed thread. The suggestion that is conveyed by these experiments is that the sexuality of an individual is not absolute but relative.

Should one seek for some feature common to all these instances, one must conclude that sex is not necessarily expressed in the form and in the appearance of the individual, but in its behaviour and reactions under certain conditions. It is the stimulus which excites sexual activity that varies as one passes from form to form ; but the method of the response to this stimulus would seem to be common to all. In heterosexuality, the stimulus that lights up sexual activity is the person or the image of another individual of the opposite sex. In homosexuality, the sexuality of the individual is released and stimulated by the presence of an identical individual. There are other forms, in which both ova and sperm mature within one and the same body and are extruded together, and in which this extrusion of gametes is not in any way dependent upon the presence o another individual. Yet such extrusion is a sexual act, and there may b observed during its occurrence every sign which is associated in other forms with the congress of two differently sexed individuals. Intense excitement, followed by calm, would seem to be the hall-mark of sexualit in its expression in all forms, either hetero-, homo-, or auto-sexual.

This imperfect discussion of the nature of sex must presently suffice One leaves the subject with a feeling of regret that biologists and layme could not be content to leave the nature of sex unexplained and to accep some simple point of view as that of Plato, who held that in the beginnin man and woman were one, but that they were divided by the wrath of th gods into two, who for ever tend to come together and unite again. Suc a view at least expresses the fundamental character of sexuality.

It is necessary next to discuss the nature of those factors which determine whether any given organism shall develop into a male or else into a female. This question is usually known as the determination of sex. Before passing on to it, however, it is desirable briefly to discuss the origin of the individual itself. This story, as does everything else in the history of biology, begins with Aristotle, the first biologist whose published works we possess in complete form. This great teacher divided animals into two classes—those which developed without parents, directly from unorganised matter by means of spontaneous generation, and those which came into being through sexual reproduction, each of the parents contributing something to the offspring. According to him, the ejaculate or semen of the male did not originate in the testes ; the true function of these organs being to delay emission of the male ejaculate until it had had time to ripen. In the female it was not the uterus (womb) or the oviducts (the tubes which lead from the uterus to the vagina, L. *ovum*=egg ; *ducere*=to lead) which provided the maternal contribution to the next generation, the material which was contributed being the menstrual blood. The process of reproduction consisted in the mixture of the menstrual blood and the male ejaculate, and in the development of an egg from this mixture. The female contributed the substance of the embryo, whilst the male contributed that formative impulse which initiated growth and determined form.

The ovaries of the mammalian female are solid bodies, quite unlike those of the bird, and were referred to by the earliest anatomists as "female testes." Galen supposed that the semen of the male was manufactured in the arteries and veins of the testes, and was thereafter sieved through these latter organs. The female semen, according to this authority, was likewise elaborated in the blood-vessels of the female testes, and the two fluids, male and female, became mixed in the uterus of the female, there to coagulate and then become frothy and thus evolve the embryo. For a thousand years this point of view prevailed.

It was not until William Harvey, greatly influenced by the previous observations of Fabricius, wrote his great book *De generatione animalium* (1651), that new concepts began to be considered. Harvey was the personal physician of Charles I, and this position provided opportunity for him to transfer his work from the incubating hen's egg to mammals. He was permitted to carry out a post-mortem examination of female deer, killed by the enthusiastic royal huntsman. Harvey found, quite unexpectedly, that the uterus of the deer, before November 12th (the date is of importance only in that it bears a relation to the normal mating season of the deer) in any of the years of his study, was completely empty, although its lining was swollen and softened. This observation supported neither the views of Aristotle (according to whom there should have been visible, during the first stages of generation, menstrual blood mingled with male ejaculate) nor those of Galen (according to whom there should have been visible a mixture of male and female semen). King Charles, interested in these findings, next permitted Harvey to have twelve does taken alive during the mating season. Some of these were killed soon after capture, and again nothing was found within their uteri. The others were kept and later gave birth to their young. It appeared, therefore, that indeed for a fortnight, or even a month after conception, nothing existed in the uterus which the human eye could discover. But, about the 12th to 14th of November, Harvey noted the presence of white filaments, like spiders' webs, becoming conjoined and presenting themselves as membranous or gelatinous sacs, and a few days later the tiny embryo could be identified amid its membranes. From these observations Harvey concluded that the spermatic fluid did not reach the uterus, but exuded an effluvium which stimulated the uterus to secrete the egg.

Another generation elapsed before further discoveries were made. Swammerdam and van Horne of Leyden developed the idea that the "female testes" of the mammal were comparable to the ovaries of birds, like them producing eggs. The same idea was included in a thesis of Stensen (1667), but whilst these were continuing their studies a third student of the Leyden group, de Graaf, published in 1668 a book which anticipated many of the points that were still being considered by the others. A later book, *De Mulierum organis generationi inservientibus* (1672), by the same author, contained a full description of the genital tract of the human female and the first real account of the ovarian follicles. He was of opinion that the whole content of the follicle was the ovum, and that what we now know as the *corpora lutea* (yellow bodies) developed in the follicular wall before the rupture of the follicle. Using the rabbit as his experimental material, de Graaf found nothing in the genital tract of those which he killed on the first or second day after mating, but on the third day he found tiny spherical bodies in the Fallopian tubes (*see Fig.* 1) and on the fourth day slightly larger spheres in the uterus. He rightly regarded these as the products of the ovary, and the forerunners of the embryos. It is interesting to note that no one else succeeded in finding embryos in the uterine tubes again until more than a hundred years had passed.

A few years later (1677) Leeuwenhoek discovered the spermatozoon in a drop of fluid obtained by one of his students from a patient suffering from a urethral discharge. Observations made on other animals revealed the presence of these animalculæ in the seminal fluid of all of these. Leeuwenhoek promptly concluded that the spermatozoon was the whol material contribution to the embryo from its parents, and that the uteru of the female was simply the place where the spermatozoon was incubated and was nourished. He denied the importance, even the existence, of th egg. Leeuwenhoek's view that the spermatozoon was the rudimentar embryo was carried to absurd lengths by his followers, one of whom published a picture of a homunculus—a miniature man—which he had observed in the seminal fluid and which had the outward appearance of spermatozoon but which, on closer examination, revealed all the characteristics of a minute human being with folded arms. From this it wa deduced that within the testes of this homunculus there was a still smalle homunculus and so on, *ad infinitum* ; Adam, the first man, therefore must have contained within his reproductive system all the generation that could follow him, enclosed one within another like the unending boxes of a Chinese puzzle.

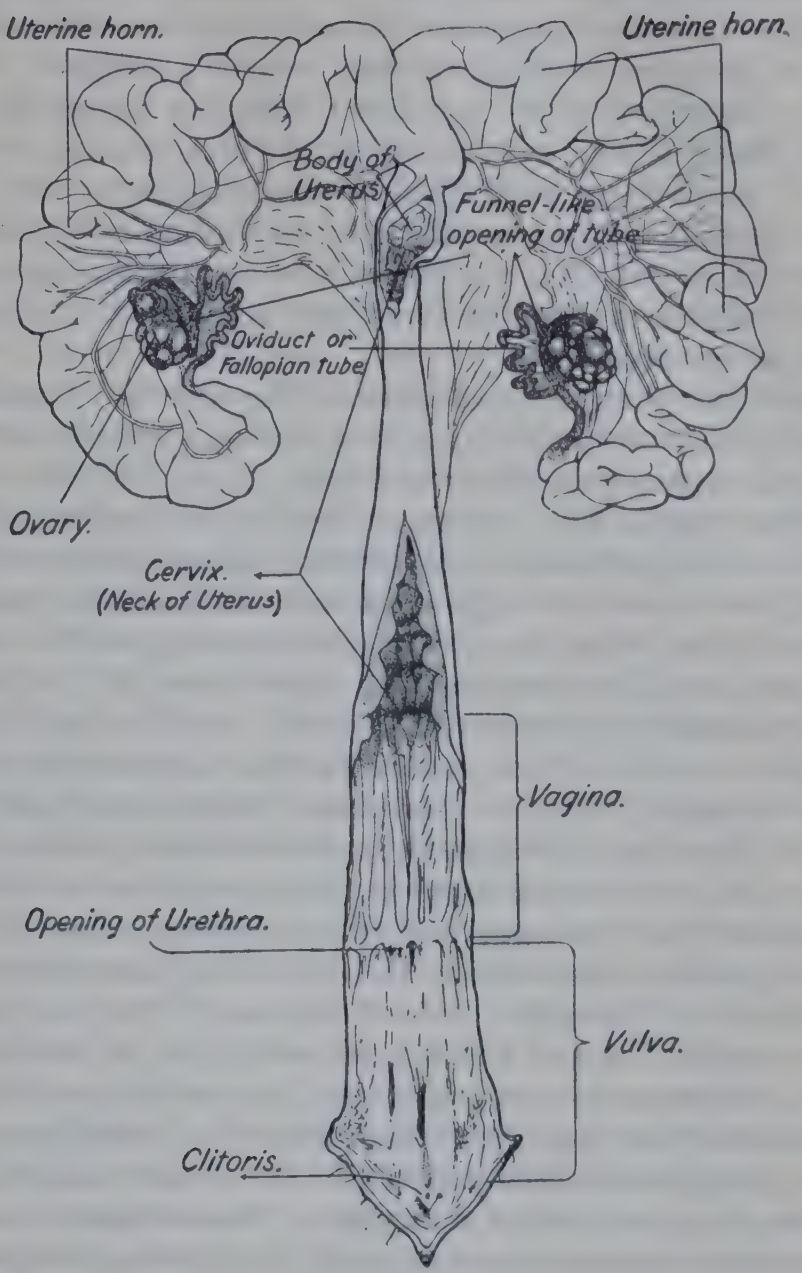

Fig. 1. GENITAL ORGANS OF SOW

The ova develop within the solid ovary. As each ovum ripens it becomes enlosed with a follicle containing fluid—the *liquor folliculi*—and moves toward ne surface of the ovary. In the diagram the follicles are seen as grape-like lusters. As the ovum ripens, this fluid increases in amount until the pressure vithin the follicle is such as to cause a rupture of the follicle wall which is exosed on the surface of the ovary. The ovum is extruded and passes into the nouth of the Fallopian tube and onwards into the uterine horn. The wound on ne surface of the ovary, thus produced, heals, and the scar tissue is peculiar in nat it is yellow in colour and glandular in structure. Such a mass of scar tissue known as a corpus luteum which elaborates specific chemical substances that lay their part in the maintenance of the state of pregnancy.

The ejaculate of the male is deposited in the upper part of the vagina, and the permatozoa make their way upwards through the cervix (the neck) of the uterus nto the body of the uterus and on into the uterine horns. It is here that sperm nd ovum meet and that fertilisation takes place.

The fertilised ovum becomes embedded in the wall of the uterus and proceeds develop into embryo and fœtus. At the time of birth the neck of the uterus ilates and the muscular action of the uterus expels the fœtus *via* the vagina to ne exterior.

Fifty years later von Haller (1752) carried out embryological studies of sheep, after the manner employed by Harvey in the case of the deer. The results he obtained confirmed Harvey's opinion that nothing was to be found in the tubes during the first part of pregnancy, and he concluded that something of an undefined character passed from ovary to uterus and there slowly coagulated into the ovum. In 1778 William Cruikshank, an assistant to William Hunter, repeated this work, using the rabbit. Cruikshank had no difficulty in finding ova in the Fallopian tubes on the third day after mating, and in the uterine horns (*see Fig.* 1) thereafter. Thus the work of de Graaf was confirmed 106 years after the publication of his results.

Then came two young men of Geneva, Prevost and Dumas, who demonstrated (1824) that complete spermatozoa were to be found in the testes, and that these organs were the site of their origin. Next they showed that by mixing the eggs and the sperm of frogs, tadpoles could be produced, but that if filtered spermatic fluid, or the vapours arising from the spermatic fluid, were used the eggs were not fertilised. Furthermore, they demonstrated that, after copulation, spermatozoa could be found in the uterus of the dog. This was the first observation of this fact, and constituted a conclusive refutation of Harvey's notion that nothing passed from the male into the upper portions of the genital tract of the female Later they found in the uterus very small bladder-like bodies, like those noted by de Graaf and Cruikshank in the uterus of a rabbit. Since they expected to find very much larger bodies than those which they found they concluded that the large ova of the ovaries—that is the Graafian follicles—contained small ovules. But when they examined the follicles in the ovary of the bitch, they did not find any of the small clear vesicles which they expected to see. But it is recorded that on two occasions they did observe minute opaque round bodies, the very objects for which they were seeking, but they dismissed them from any consideration.

The two men parted shortly after this work was completed, and their opinions developed somewhat divergently. Prevost gave it as his opinion that spermatozoa and ova together yield the embryo ; but held the view that neither of them formed any part of the actual tissues of the embryo He seems to have thought that the sperm and the egg interacted to secrete the embryo in the uterus. Dumas on the contrary believed that the sper matozoon, having united with the ovum, became the nervous system o the embryo, the ovum contributing the rest.

The next great figure in this history is von Baer. It was he who actually discovered the mammalian egg (1828). Unlike his predecessors, he, using the dog, worked backwards from twenty-four days old embryos, taking the later stages of development first. He traced the embryo from th uterus on into the Fallopian tube. Having decided that the next step in his investigation was the examination of the ova in the ovary itself, h opened up a follicle and took out therefrom a yellowish white point which was floating in the fluid. Placing this under a microscope, he saw "an ovule," exactly similar to those that he had previously found in th Fallopian tubes. In 1866 Gegenbaur was able to prove that in all animal the ovum is a single cell. It was not until 1875 that Hertwig demonstrated the actual union of egg and spermatozoa.

Thus was the story completed. A spermatozoon, a single cell produced by the testis of the male, unites with an ovum, a single cell produced by the ovary of the female, to form the new individual.

Every individual, whether male or female, develops from an ovum fertilised by a sperm—apart, of course, from the occurrence of asexual and parthenogenetic reproduction. What, then, determines that the fertilised egg shall develop into a male or else into a female ?

Many are the theories relating to this problem of sex-determination that have been propounded which were doomed to pass into the limbo of forgotten things as advances in our knowledge were made. Many of them are based on discoveries which are still made anew almost every year. For example, the theory, as advanced by Schultze, that there are two kinds of ova, destined respectively to develop into males and females, is still promulgated anew with the greatest regularity by people who have apparently not heard of each other, of Schultze or of recent developments in our knowledge of the structure and constitution of the living cell. Hofacker (1923) and Sadler (1930) independently suggested that when the male parent is the older the offspring are predeterminedly male, whilst if the parents are of the same age, or if the male be the younger, emale offspring appear in increasing majority. This conclusion, generally known as the Hofacker and Sadler law, has received, and still receives, oth confirmation and perplexing contradiction, as might be expected, when one remembers how critical it is necessary to be while making a tatistical study in which all the factors cannot be considered. One of the est known, and probably one of the most influential, theories concerning sex-determination is that, as elaborated by Girou, which refers to the omparative vigour of the parents. The hypothesis connects the sex of he offspring with that of the more vigorous parent. A variation of this orm is that which refers to the superiority of one or the other sex. According to Starkweather, for example, sex is determined by the superior arent, the superior parent producing the opposite sex. Such a theory as his has little more than verbal simplicity to commend it, for, indeed, ow shall one define superiority ?

But enough of hypotheses. There are certain facts of general biology ow known which are not susceptible to interpretation of this kind. These acts point directly to the view that in the higher animals, at least, sex is etermined at the time of fertilisation by the workings of a relatively mple mechanism to be found within the cell itself.

In the human subject there are two kinds of twins—identical and raternal. Identical twins have their origins in a single fertilised egg, hile fraternal twins have their origins in two ova, each of them fertilised y a separate sperm. Identical twins are always of the same sex, and are emarkably alike in their general characterisation. Fraternal twins may r may not be of the same sex, and they are no more alike than are ordinary brothers and sisters born at different times. Now, there is no ppreciable reason why, if purely environmental factors were at work in etermining the sex of the offspring, twins produced from one egg should e of one and the same sex, while twins produced from separate eggs hould include both males and females. This evidence points directly to

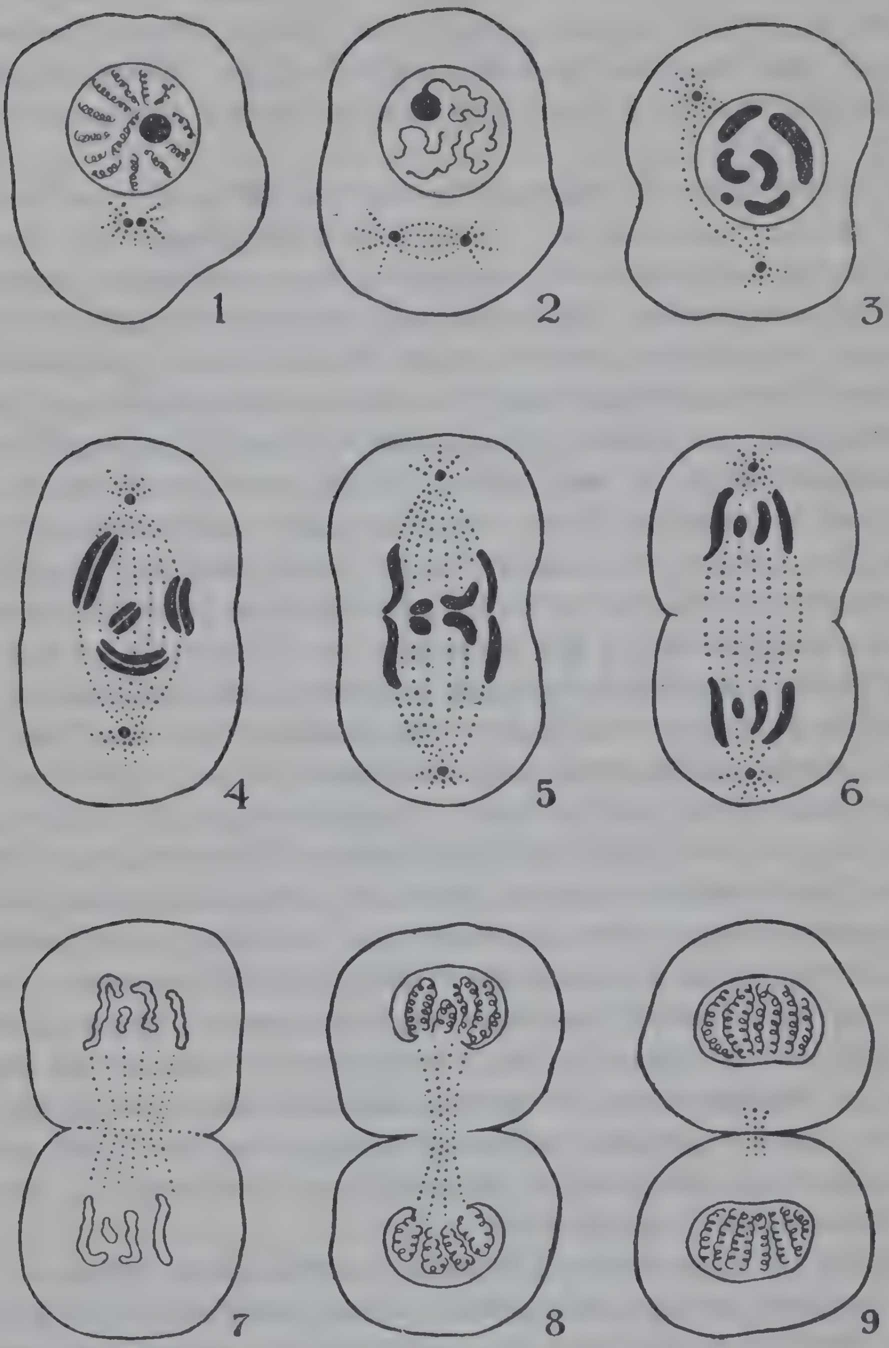

Fig. 2. DIAGRAM OF CELL DIVISION SHOWING THE BEHAVIOUR OF THE CHROMOSOMES

(1) The resting cell about to divide. (3) The chromatin of the nucleus becomes aggregated into the chromosomes. (4) These chromosomes come to l at the equator of the cell, the wall of the nucleus disappears, fine fibrils radia from the two " stars " which have separated, the chromosomes divide longitudinally into two. (5) The half-chromosomes separate and travel toward th opposite poles. (6) The cell shows signs of division at the equator. (7–9) Th chromosomes lose their distinctness, the division of the cell continues, the wa of the nucleus reappears and finally two daughter cells are produced.

the conclusion that the sex of the individual is determined by the constitution of the fertilised ovum at the time of fertilisation.

Although it is quite impossible to distinguish between that fertilised egg which is to become a male and that which is to become a female, by means of the naked eye, it can be shown, by the use of appropriate techniques, that very significant differences between them do indeed exist. As has been said, the architectural unit of the body is the cell. The egg and the spermatozoon are each of them a single cell. The cell possesses a typical organisation. Centrally there is the nucleus which dominates all the activities of the cell, and around it in the general body of the cell there is the rest of the living protoplasm, commonly loaded with particles of non-living matter. Examination of microscopic sections of tissues, appropriately stained, shows that the nucleus includes a mass of material which in a resting cell (*see Fig*. 2. 1) takes the form of a tangled skein and which, because of the ease with which it takes up dyes, is known as chromatin (Gk. *chroma*=colour). Sections showing cells at different stages of cell division reveal the fact that this chromatin, as cell division proceeds, becomes aggregated into a definite number of clumps or rods which are known as chromosomes (Gk. *chroma*=colour; *soma*=body; *ee Fig*. 2. 3). It is a startling and significant fact that the number of chromosomes is characteristic of the species to which the individual beongs, and, moreover, that they exist in a cell in the form of pairs, the members of a pair being identical. Further study reveals the fact that whilst the rest of these pairs of chromosomes, said to be homologous for he reason that they are similar in origin and structure, are alike in the wo sexes, there is one pair in respect of which male and female differ. In its simplest form this difference consists of the presence of a pair in he one sex, and of a single chromosome in the other.

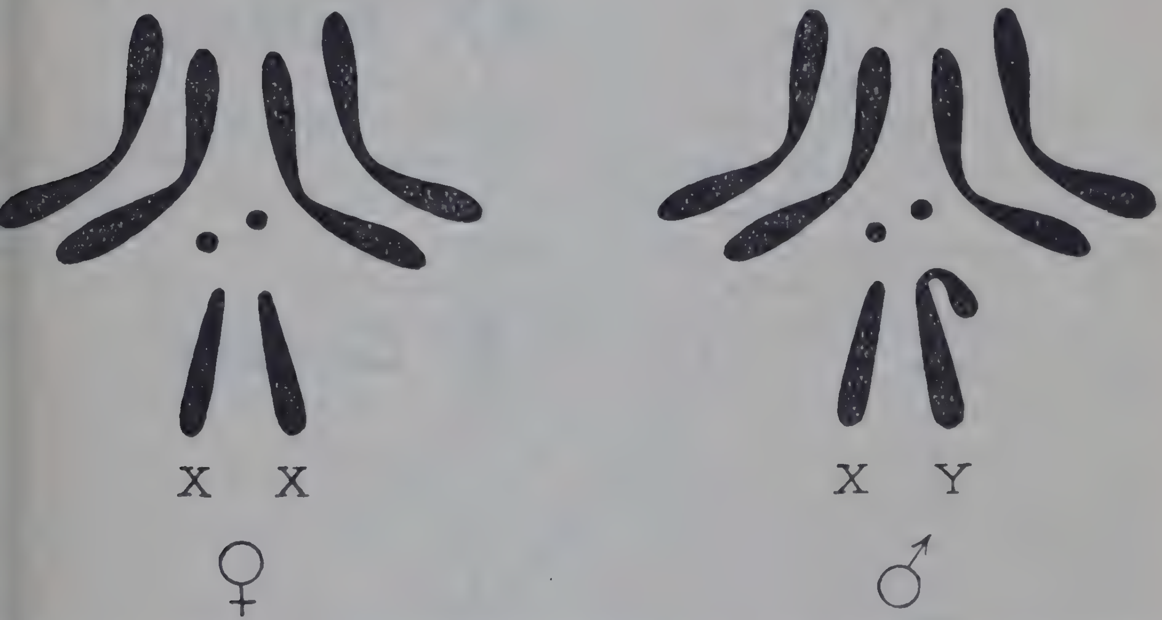

Fig. 3. CONVENTIONAL DIAGRAM OF THE CHROMOSOMES OF A FLY, *DROSOPHILA MELONOGASTER*

For purposes of discussion, these chromosomes in respect of which the sexes differ are referred to as the *sex-chromosomes*, in contrast with the rest which are known as the *autosomes*, and the individual sex-chromosome itself is known as an X-chromosome. In many forms the difference consists in the presence of a pair of identical members in one sex (XX), whilst in the other there is a single X and an unequal mate, the so-called Y-chromosome. In these cases, then, male can be distinguished from female for the reason that in all the cells of the body and in the unripe gametes of the former, there is either a single X, or else an X and a Y, whilst in the case of the latter each cell of the body and each unripe egg contain two X-chromosomes.

It is established that in the ripe gamete, egg or sperm, there is to be found one member of each pair of homologous chromosomes which are present in the cells of the body and in the unripe gamete. This reduction in the number of chromosomes is effected by what is known as th "reduction divisions" during the formation of the gametes. These d not occur during ordinary cell-division whereby the body, its organs an tissues, increase in size or effect repair; they are special divisions durin gametogenesis. Before a cell divides into two there is a previous longitudinal division of the chromosomes (*see Fig.* 2. 4), that is to say, there i multiplication of the chromosomes, and of each original chromosom one half passes into each of the two daughter cells (*see Fig.* 2. 6). As result, each receives that number of chromosomes which is characteristi of the species. But in gametogenesis, instead of each chromosom

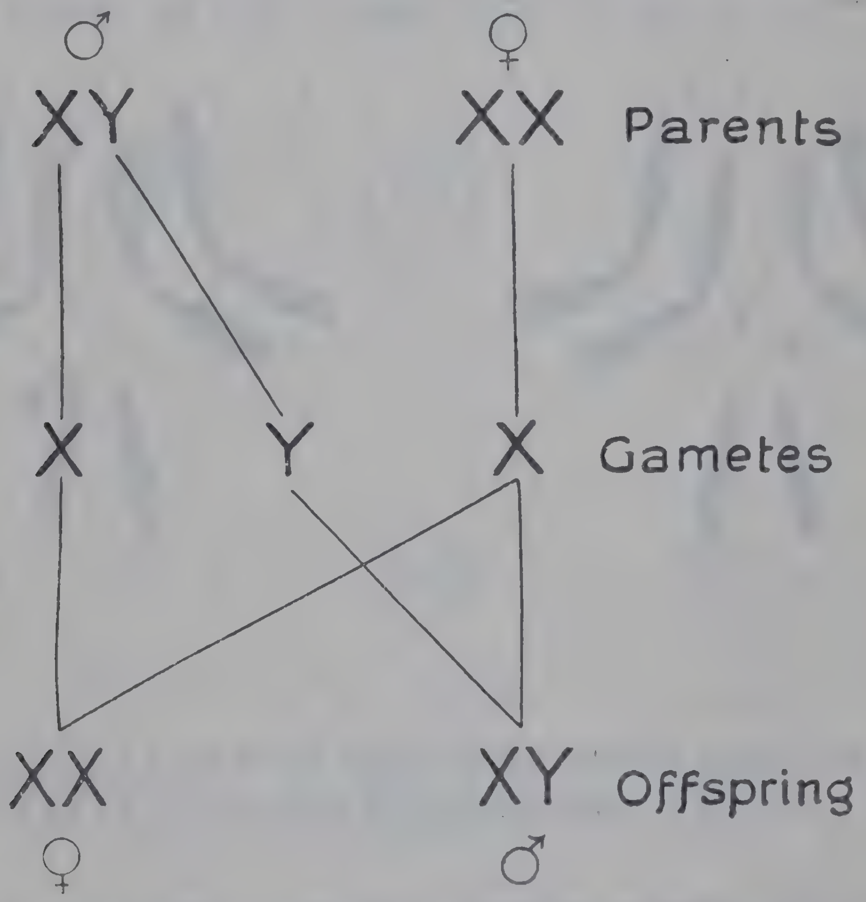

Fig. 4. THE SEX-CHROMOSOME SEX-DETERMINING MECHANISM

dividing into two, the two members of each pair of homologous chromosomes fuse. So that on examination there would appear at this stage to be only half the correct number of chromosomes. Later the two members of each pair separate and one passes into each daughter cell. Thus each of these will come to contain only half the number of chromosomes which is characteristic of the species.

It follows, therefore, that in each egg there will be one X-chromosome, whereas in the case of a species in which the male is XY in sex-chromosome constitution there will be two sorts of spermatozoa, one including an X- and the other including a Y-chromosome. The male is *digametic* in these forms, the female *monogametic*. The new individual has its origin in the union of egg and sperm. It can therefore have its beginning in the union of an X-bearing egg with an X-bearing sperm, and become an XX individual (a female), or else in the union of an X-bearing egg with a Y-chromosome bearing spermatozoon to become an XY individual (a male) (*see Fig*. 4). This sex-determining, sex-chromosome-distributing mechanism yields results which are entirely in accord with observed facts, and the list of species in which this sex-chromosome distinction between the sexes has been found to exist is enlarging yearly.

That sex is determined at the time of fertilisation and by means of this sex-chromosome, sex-determining mechanism is supported by the facts of what is known as sex-linked inheritance. In the case of a species in which the male is XY in sex-chromosome constitution and the female XX, the son, who, to be a son, must receive one X-chromosome and one Y, must get his single X-chromosome from his mother, since it is the Y that he will receive from his father; whilst the daughter must get one X from each parent. If on the X-chromosome of the father is borne the hereditary factor for a recessive character, then the track of this chromosome in inheritance can be followed if the Y-chromosome of the male carries no hereditary factors which in any way affect the action of those borne upon the X. Colour blindness—the inability to distinguish between red and green—is an example of a sex-linked recessive character. If a colour-blind man marries a normal-sighted woman, then the sons of this marriage will all be normal, but the daughters, though normal themselves, will carry the hereditary factor for this abnormal condition. Should a colour-blind man marry a daughter of such a marriage, then of he sons 50 per cent. will be colour-blind and 50 per cent. will be normal, whilst of the daughters 50 per cent. will be colour-blind and 50 per cent. will be carriers. If a carrier woman should marry a normal man, then of the ons 50 per cent. will be colour-blind and 50 per cent. normal, whilst of he daughters, 50 per cent. will be carriers and 50 per cent. normal. These statements refer to observed facts.

By means of this scheme the reader can for himself predict the disribution of colour-blindness among the offspring of any marriage. Let X underlined so, $\underline{X}$, indicate that on this X-chromosome the factor for olour-blindness is borne. There can thus be two kinds of males, colour-blind males, $\underline{X}Y$, and normal males, XY. But, there are three kinds of women; colour-blind, $\underline{X}\underline{X}$; carrier women, $\underline{X}X$; and normal women, XX. A carrier of a recessive character is an individual in whose herediary constitution there lies hidden the factor for this particular character.

It is not expressed because it is covered by the dominant character of normality. Thus, on one X-chromosome of a woman, a carrier of colour-blindness, there is this factor (X), but on the other, the alternative factor for normal vision is present. If a woman is to be colour-blind, she must have a double dose of this colour-blind factor : for a man to be colour-blind, he needs but one, for the reasons that he has only one X-chromosome and that on the Y-chromosome there is not the factor for normal vision.

These and similar facts can be explained easily and satisfactorily if it is assumed that the hereditary factor for colour-blindness is resident in the X-chromosome, that the presence of one X-chromosome in the chromosome constitution of an individual leads to the development of maleness, whilst the presence of two X-chromosomes leads to the development of femaleness, and, finally, that the sex of the individual is determined at the time of fertilisation by the workings of this sex-chromosome-distributing mechanism.

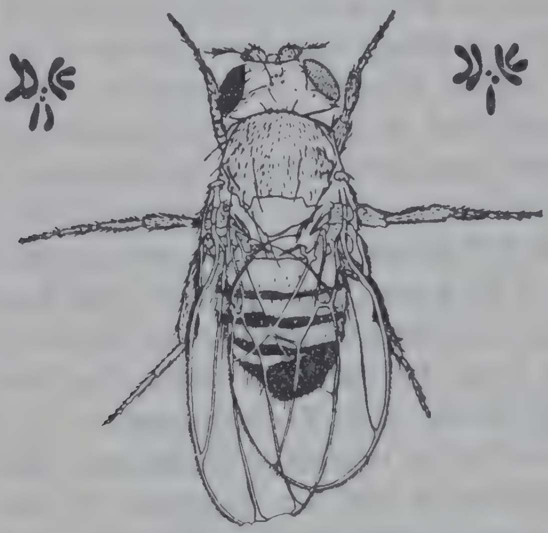

Fig. 5. A LATERAL GYNANDROMORPH *DROSOPHILA MELONOGASTER*

The left side is red-eyed and female in type ; the right side is white-eyec (a sex-linked recessive character) and male in type. The cells on the left sid contain two X-chromosomes ; those on the right side contain only one. Sinc the mother of this fly was white-eyed and the father red-eyed, and since red i dominant to white, we are enabled to state that it was the X-chromosome fron the father that was lost.

The very clearest light is thrown upon this sex-determining mechanisn by what is known as gynandromorphism in insects (Gk. *gyne*=woman *aner*=man ; *morphe*=form). A gynandromorph is an individual which i a sex mosaic in space, exhibiting both male and female characters. In lateral gynandromorph half of the body is male, the other half is female It has been shown that this abnormality in the regional distribution of th sex characters is associated with, and can be explained by, an abnor mality in the distribution of the X-chromosomes. The gynandromorph i an individual which has its origin in the fertilisation of an X-chromosome bearing egg by an X-chromosome-bearing sperm to become a geneti female—XX in sex-chromosome constitution. The fertilised egg i which this individual has its origin becomes the individual by continue cell division. First of all the egg divides into two, and this division involves a previous longitudinal division of all the chromosomes, which, as has been said, exist in the form of pairs, and of each pair one member has come by way of the sperm from the father, the other by way of the egg from the mother. As a result of this division of the chromosomes, each daughter cell receives exactly that number of chromosomes which is characteristic of the species. Each of the X-chromosomes of the fertilised egg divides longitudinally and into each daughter cell there passes one half of each. If at this first division of the fertilised egg one of the daughter X-chromosomes fails to pass into one of the daughter cells, then that cell and all its descendants will contain only one X-chromosome nstead of two. Furthermore, if in respect of sex-linked characters the father and the mother differ, it becomes possible, by reference to the characterisation of that half of the body the cells of which contain only one X, to recognise which X, paternal or maternal in origin, has been eliminated. Examination of the tissues of such a lateral gynandromorph

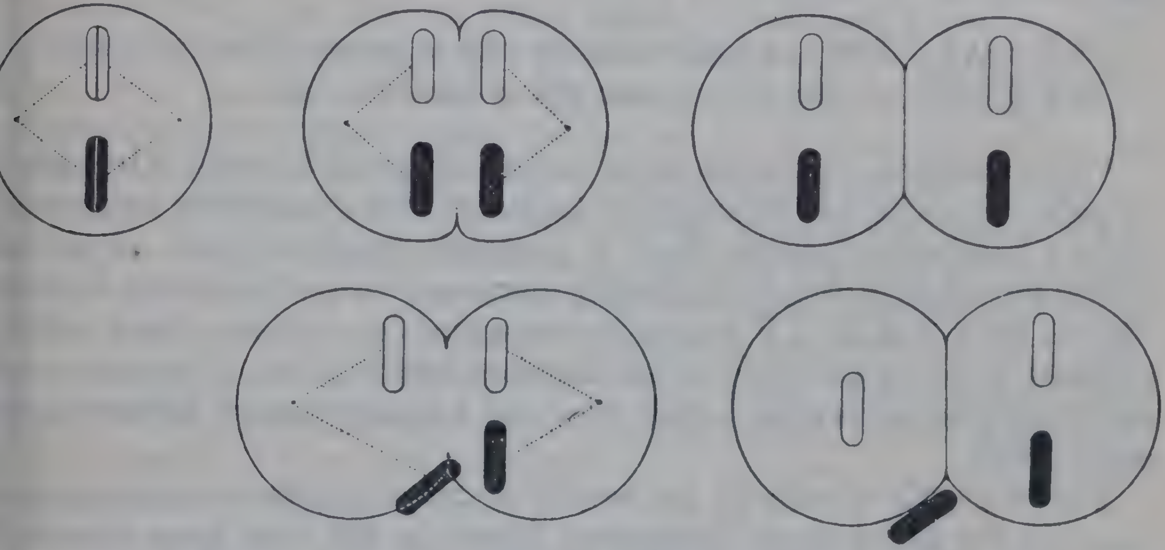

Fig. 6. DIAGRAM ILLUSTRATING THE CAUSE OF GYNANDROMORPHISM

Above is shown the normal distribution of the X-chromosomes; below s seen the daughter X-chromosome excluded from the daughter cell.

as shown that this explanation is the correct one, for the cells of the male half of the body include only one X-chromosome, whereas the cells f the female half include two. It is interesting to note that of the two ides of the body in the case of these forms one has its origin in one of the aughter cells produced by the first division of the fertilised egg, the ther half having its origin in the other daughter cell (*see Fig*. 6).

From this and other evidence it follows that in the body cells of the emale tissues there are two X-chromosomes in association with two of ach of the autosomes, so that, if A represents one complete set of autosomes as present in the ripe ovum, the quantitative relation in the body ells and in the unripe gametes between the sex-chromosomes and the utosomes can be expressed by the formula 1X : 1A; whereas in the male ne relation of X-chromosomes to autosomes is expressed by the formula X : 2A.

For purposes of discussion, by far the simplest method of constructing a thought model of the sex-determining mechanism is to assume that on the X-chromosome of these forms are hereditary factors that are female-determining, and that on the autosomes are others that are male-determining, and that the sexuality of the zygote is determined by the balance between these. If F represents one set of such female-determining factors on the X-chromosome, if M represents one set of the male-determining factors on one set of the autosomes (A), and if in their relationship 1F is greater than 1M, but less than 2M, then

(FX) (FX)MM is a female because 2F is greater than 2M ; whereas
(FX)Y(MM) is a male because 1F is less than 2M.

A complication enters here. In the moth and the bird it is the female and not the male that is digametic. Symbolised, her sex-chromosome constitution is XY, and that of the male XX. In these cases it is necessary to place the male-determining factors on the X and the female-determining factors on the autosomes, so that

(MX) (MX) (FF) is a male because 2M is greater than 2F ; and
(MX)Y(FF) is a female because 1M is less than 2F.

These formulæ, of course, must not be taken too literally. They are to be regarded as simple attempts to explain a very imperfectly understood subject concerning which there is presently profound lack of physiological knowledge. But it is certainly necessary to postulate that in every zygote, be it XX or XY in sex-chromosome constitution, there are the physical bases of developmental impulses which strive to impose upon the developing individual a male type and a female type of differentiation respectively.

This is clearly shown by the results of crossing different geographical races of the gypsy moth *Lymantria dispar*. It has long been known to entomologists that when these are crossed sexual abnormalities are commonly present amongst the hybrid offspring. For example, if European specimens of the gypsy moth are bred amongst themselves, their offspring are perfectly normal in every way. The same is true of the Japanese variety. But should a Japanese male be mated with a European female the offspring consist of normal males and of females that are intersexua in that they show a number of modifications in the direction of maleness The reciprocal cross, European male and Japanese female, yields norma males and females, but if the individuals of this generation are interbred then, in the next hybrid generation, there appear a proportion of males that are intersexual, that is, that show modification in the direction of the female type of sex-equipment. This problem has been studied very thoroughly by Goldschmidt of the Kaiser Wilhelm Institut für Biologie Berlin-Dahlem. He has found that in respect of their ability to produce intersexual forms when crossed, there are very many different races of European, Japanese and American gypsy moths. As a result of grea numbers of matings between different races, Goldschmidt has been able to classify his strains as relatively " strong " or " weak." For example a strong male mated to a weak female would give 50 per cent. norma males and 50 per cent. intersexual females. A very strong male mated to weak female would give offspring all exhibiting the male type of sex-quipment. Out of his experience there came to him the possibility of redicting the results of any particular cross, and to produce every grade f intersexuality. It was noted that this intersexual condition did not ffect all the structures of the sex-equipment equally, and he found that e could arrange the different structures in a definite series as regards he degree of intersexuality, and that this series was exactly the opposite o the order of the time of their appearance in development. Those struc-ures which were the first to be developed were the last to become odified : those that were developed last were the first to be changed. In rder to explain these facts, Goldschmidt postulated that each individual ossesses the potentialities of either sex, since each can become inter-exual. The sex-chromosome constitution of the female is XY ; that of the ale XX. He places the female-determining factors in Lymantria on the -chromosome of the female, and was forced to postulate that these ctors elaborated their female-determining substances in the imma-ure egg before the X- and the Y-chromosomes became disjoined. (It will e remembered that the immature gamete possesses a pair of sex-hromosomes, but that the ripe gamete includes but one single sex-hromosome. In this case the ripe egg contains either an X or else a Y.) ecause the female-determining factors of the Y function before the gg has become finally ripe, substances, possibly enzymatic in nature, aborated by the female-determining factors, pervade the immature egg nd therefore pervade also both the final egg including an X-chromosome nd that containing the Y. He places the male-determining factors on the -chromosome. Furthermore, he postulates that since the different races n be classified as relatively “ strong ” or “ weak ” in respect of their x-determining powers, these male-determining and female-determining ctors themselves must vary in their relative strength. This concept can illustrated in a simple fashion.

If F represents the female-determining factors borne upon a -chromosome, then to this F can be assigned a numerical value : *e.g.* $_5$, F_4, F_3, F_2, F_1. Similarly, if M represents the male-determining factors rried by an X-chromosome, then the relative strengths of different ale-determining factors can be represented by M_5, M_4, M_3, M_2, M_1. It ill be noted that the female-determining impulses are always received way of the egg from the mother. It follows, then, that in respect of the rength of the female-determining impulses all eggs of one and the me female will be alike. The female will receive her X-chromosome, d therefore her male-determining factors, from her father. The male ssesses two X-chromosomes and therefore two sets of male-determining ctors (M), and one of these will have been received from either parent, d these themselves may differ one from the other in respect of their rength. A male has its origin in an egg, and therefore into this egg will ve passed the elaborated products of the female-determining factors of s mother. His constitution can be represented therefore by MMF ; e constitution of the female by MF. We can now give to these sex-termining factors numerical values. For example, consider the follow-g mating :

$$\text{(a strong male) } M_5M_5F_6 \times \text{ (a weak female) } M_2F_3$$

The spermatozoa provided by the male will each contain M_5 (no female-determining factors will pass into these gametes for the reason that according to the argument these come only by way of the egg). The gametes of the female, on the other hand, will be of two kinds : those with an X-chromosome which will have the constitution M_2F_3, and those without an X-chromosome which will have the constitution F_3. Fertilisation will result in the appearance of two kinds of offspring—$M_5M_2F_3$ (a male because there are two X-chromosomes and because $5 + 2 = 7$ and 7 is greater than 3 : because, that is, M is greater than F) and genetic females, XY in sex-chromosome constitution, but, since 5 is greater than 3, they will all possess the male organisation (that is they will be examples of complete sex-inversion of females into males).

The simplest method of envisaging what is happening is to assume tha the different strengths of male- and female-determining factors elaborat their products at different rates ; that an M_5, for example, as compare with an M_2, is a male-determining factor which elaborates its product much more quickly. If this is so, and if the relation of male- an female-determining factors can alter during that period of developmen when the sex-equipment is being laid down, then one can accommodat all the facts by what is known as the time law of intersexuality. In th normal male M is always greater than F during that time of the individual's life when the sex-equipment is being laid down. In the female F is always greater than M. But if it should so happen that these sex differentiating substances are produced at different rates, then ther exists the possibility that sex-mosaics in time will be produced. If, fo example, in the case of a female, the male-determining reactions shoul operate at a greater rate than do the female-determining reactions, the the former may overtake and finally supplant the latter. If there is a seria order in the events of sex-differentiation, that is to say, if one can mak a time-table representing the relative time of appearance of the variou characters of the sex-equipment, then the degree of intersexuality wi be determined by the time during this process of differentiation of th sex-equipment when one type of sex-differentiating reaction overtake and replaces the alternative type. An intersexual female is a female whic has pursued a normal female development up to a particular point, bu which thereafter switched over and pursued a male type of differentiatio According to this hypothesis it is not the absolute but the relative rat of production of male- and female-differentiating substances that co trol and model the sex-equipment. It is to be noted that not every pa of the body is involved in this condition. Only the structures of the se equipment are concerned, and of these only those whose differentiatio is not complete at the time are affected by the switch-over. The earli in development the switch-over occurs, the more structures of the se equipment will be affected, and therefore the greater will be the degr of intersexuality. Intersexuality of this kind is the result of a quantitati disharmony between the male and the female sex-determining facto It is inborn, for it is nothing more or less than the expression of the her ditary constitution of the individual. If the seeds of this disharmony a in the fertilised egg, then inevitably this kind of intersexuality will beco expressed as development proceeds.

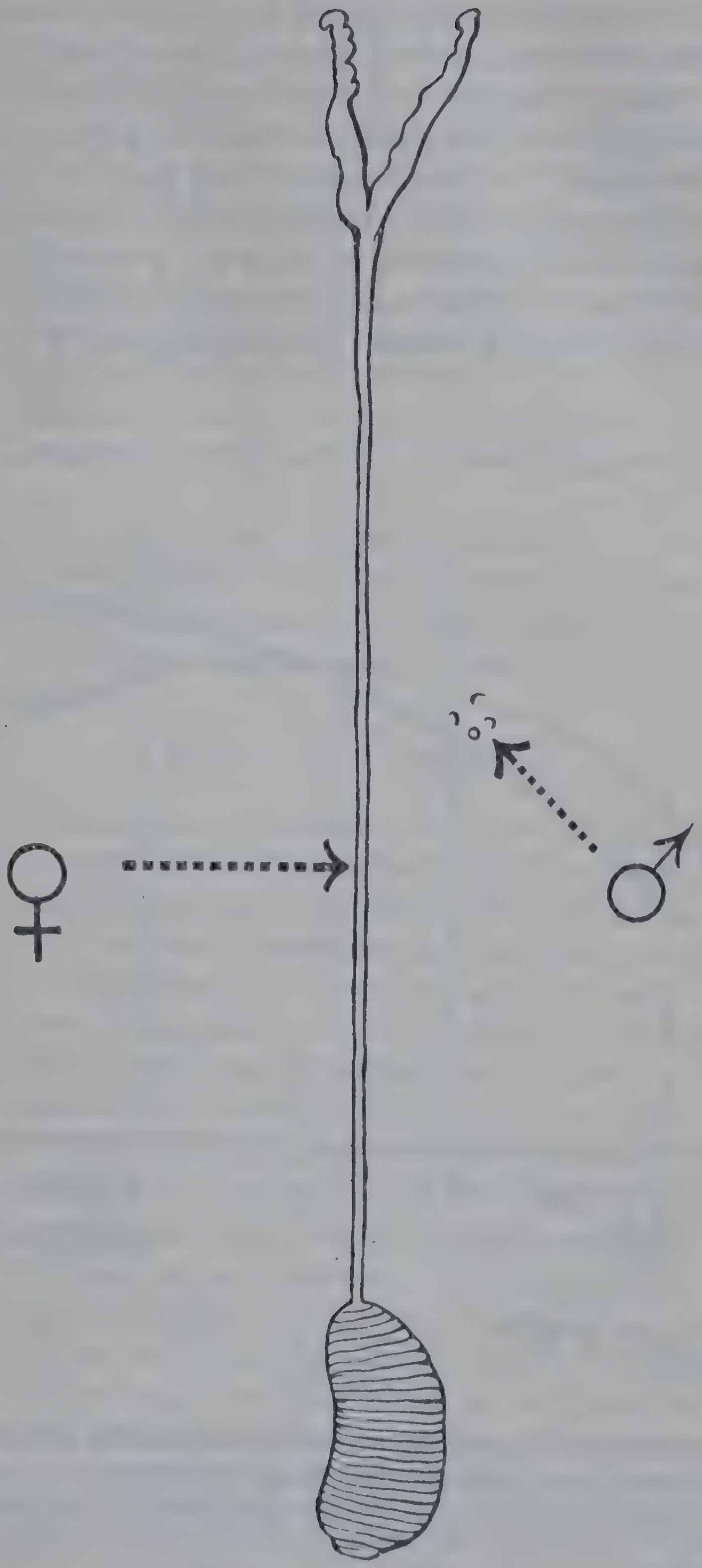

Fig. 7. BONELLIA

Intersexuality very similar in its general appearance can, on the other nd, be the result of the overwhelming of the hereditary constitution of individual by the impress of external agencies. Bonellia is a marine ganism in which sex-dimorphism is most pronounced. The female has ulky bean-shaped body about two inches long, and extending from one le of this there is a very long tube-like proboscis ending in a bifurcation *e Fig*. 7). She rests at the bottom of the water with her body hidden nongst stones and her proboscis protruding in search of food. The male a microscopic pigmy consisting of nothing but reproductive organs. He lives within the reproductive passage of the female, obtaining from her everything that he needs for life and in return fertilising the eggs that she produces. The young Bonellia is a free swimming form, floating on the surface of the waters, and amongst them there is no sex-dimorphism, all the individuals are alike. As they develop they begin to sink toward the sea bottom, and the sexual fate of the individual is determined entirely by chance. If one should settle on or near the proboscis of a female it becomes a male. If, on the other hand, it settles at a distance far removed from a female, it becomes a female. If an individual which has been in

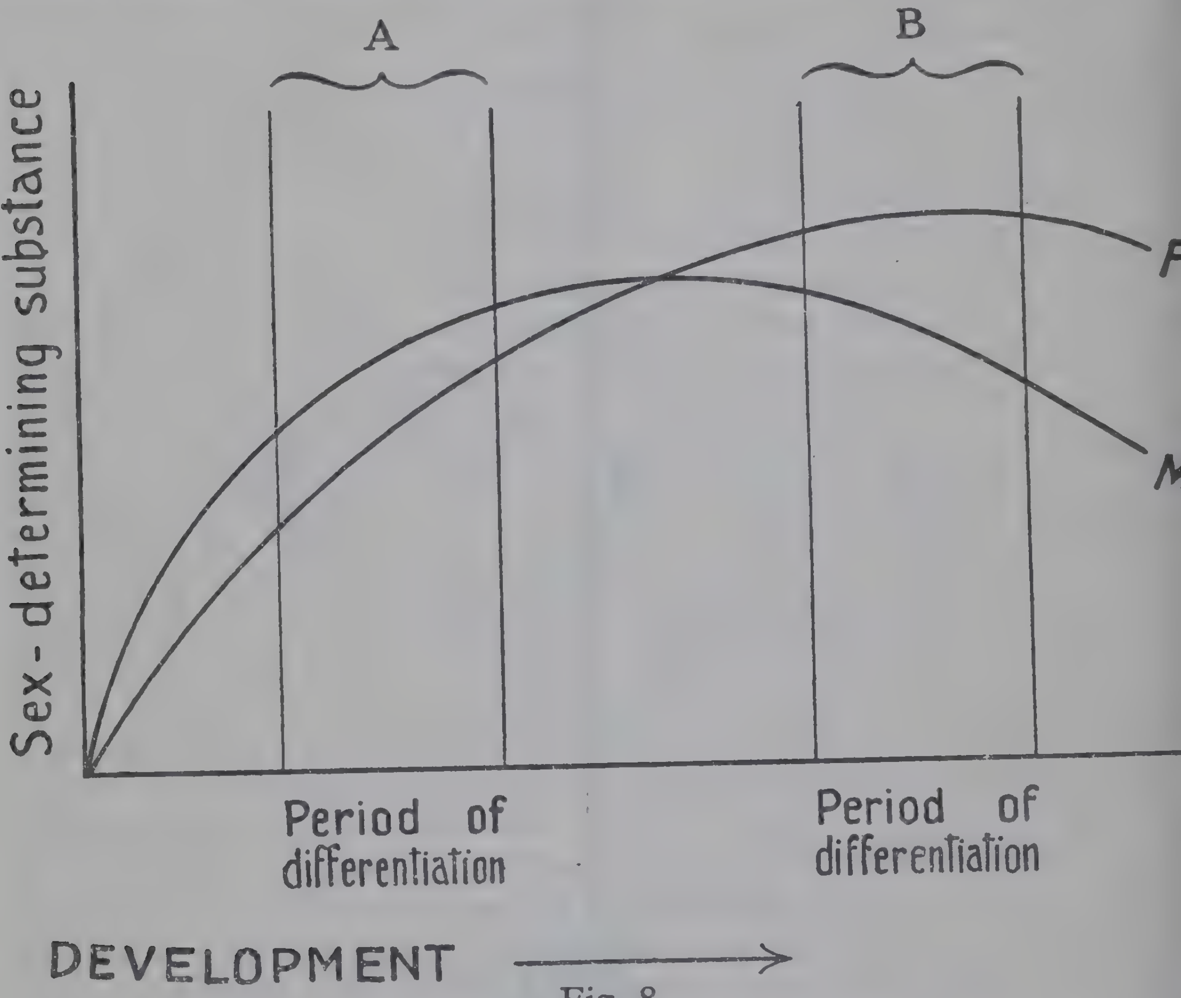

Fig. 8.

If the differentiation of the sex-equipment occurs early (A), then it is pursue under the influence of the male-determining reactions ; if it occurs later, the it comes under the influence of the female-determining reactions. The effect the stimulus of the female's proboscis is to cause the sex-equipment to differentiated as A.

contact with the proboscis of a female for a time, and which is therefo developing the male characters, is removed and kept apart from a femal the mode of differentiation changes and the sex-characters which are sti to be developed are those of a female. Extracts made from the probosc of females and added to the water in which larval forms are living induc a male type of differentiation in these.

It may be assumed that Bonellia, like Lymantria, has a sex-chromo some, sex-determining mechanism, but it is seen that even though th be the case the determination of sex is not effected thereby. The fac have been explained as follows. During the early stages of developme n Bonellia, the male-determining reactions are effectively in excess of the emale-determining reactions. A little later, however, the female-deter- nining reactions gain the ascendency. If this be so, then if the differentiation of the sex-equipment of the individual occurs early in life, it vill take place under the control of the male-differentiating reactions. If, n the other hand, the differentiation of the sex-equipment is somewhat lelayed, then it will occur under the control of the female-differentiating eactions. The effect of the chemical substances contained in the pro- oscis of the female is to produce a precocious development of the sex- quipment, so that any individual exposed to the action of these sub- tances will develop a male characterisation; whilst any individual vhich is not exposed to their action will become a functional female *see Fig*. 8).

Broadly it can be stated that in many forms sex is determined solely nd finally by the workings of the sex-determining, sex-chromosome- listributing mechanism; whereas, in other forms, the action of this nechanism is conditioned by, and can be overwhelmed by, the impress f external agencies.

THE SEX-HORMONES

In its beginning, the male amongst mammals has a hereditary con- titution which is represented by the formula XY and the female by XX. t this stage the individual is but a fertilised egg, and much must happen efore it can become a functional male or functional female possessed of he appropriate characterisation. With development there comes the lay- ng down of the sex-equipment, and at the end of development one can e distinguished from the other by differences in anatomical structure, in hysiological functioning and in mental characterisation. In the verte- rates (back-boned animals) this initial sexuality, which is but the direct xpression of the action of the hereditary factors, is strongly reinforced vhen the sex-glands of the individual have become differentiated. At this tage of our knowledge it must content us to assume that the normal male evelops testes for the reason that in the beginning he had a hereditary onstitution which we can symbolise as 1X:2A, and because, during the me of his development, the male-determining reactions were always ffectively in excess of the female-determining reactions. Similarly, we nust assume that a female develops as a female because in the beginning he had a hereditary constitution which we can symbolise as 1X:1A, and ecause during her development the female-determining reactions were ways effectively in excess of the male-determining reactions.

The results of experimental castration, and of implantation of testi- ular and ovarian tissues, have demonstrated clearly the intimate rela- on between the type and the degree of the sex-characterisation on the he hand, and the structure and functional activity of the sex-glands on e other. The stag bears horns, and his accessory sexual apparatus in- udes penis and scrotum, and these are associated with the presence in s body of testes. In the hind the ovaries are associated with the presence a uterus, well-developed mammary glands, absence of horns, or else a fferent pattern of horns, and different body shape. This association of rious characters with testis and ovary respectively is so intimate, that one has no hesitation in identifying the sex of an individual by reference to the structure of its sex-gland. Indeed it can be said that a female is a female in virtue of her ovaries ; a male a male in virtue of his testes.

These sex differences associated with differences in the type of sex-gland pervade the whole organism. It has been found, for example, that the cells which comprise the female body commonly are smaller than those of the male, that there is a difference in the rate of respiration, in the rate of the pulse, in the intensity of the metabolism (Gk. *metabole*= change), the constructive and destructive chemical changes occurring in living organisms, and in many other bodily functions which, at first sight seem to have nothing to do either with the structural or with the functional characters of sex. That many of such characters depend for their existence and maintenance upon the normal functional activity of the sex-gland is shown in the clearest possible fashion by the results of experimentation. After removal of the sex-gland, changes can be noted in the form and degree of expression of those structures and functions which depend for their initial expression and maintenance upon this gland.

For a long time the view was held that the sex-gland produced its effect through its nervous connections with other parts of the body. Indeed, i was not until the middle of the last century that this attempted explanation of the intimate relation between the sex-gland and the general sex characters was destroyed, as a result of critical experimentation. Th cock, after castration, does not crow ; his comb rapidly diminishes i size, and becomes pale. But it was found that if pieces of testis were implanted under the skin of such an animal, the signs of castration did no appear, although the testicular grafts had no connection with the duct which carry the spermatozoa toward the exterior and had no nervou connection with the rest of the body.

When first these experiments were carried out, the theory was propounded that the testicle must elaborate a substance which is secrete into the blood stream and is carried thereby throughout the body, thu reaching all organs, influencing them and directing their differentiatio That this conception was fundamentally correct is shown by the fact tha within recent years it has been found possible to extract from the testes o domestic animals a substance which, when injected into castrated male prevents the development of those changes which invariably occur afte removal of the male sex-gland. This substance is known as " the ma sex-hormone " (Gk. *hormao*=I excite). A hormone (a chemical messenge is a substance elaborated by a glandular organ, passing therefrom direct into the blood stream and thus being conveyed to all parts of the bod and stimulating or depressing the functional activity of distant organ The male sex-hormone is regarded as being that particular elaborate product of the testis which is responsible for the expression and mai tenance of the male characters.

Similar experiments have been carried out in the case of the femal It has been shown that a grafted ovary can maintain the general expressio of femaleness in a female from which the ovaries have been previous removed. The injection of extracts derived from certain parts of the mammalian ovary induces the mating reactions in such ovariectomised mic which otherwise would never attract or receive the male. It also brin about complete development of the uterus and vagina and induces growth n the mammary glands. It follows, then, that functional sexuality in either sex is essentially a reaction on the part of the body to a particular sex-hormone, male or female.

As was to be expected, a very considerable amount of experimentation has been carried out, having for its object the demonstration of the results of the implantation of ovary into a male and of testis into a female, and of he effects of the injection of male sex-hormone into a female and of female ex-hormone into a male. It was Steinach, of Vienna, who first approached his problem. He used the guinea-pig as his experimental material, for he reason that in this form sex-behaviour is well differentiated in the two exes and the differences between the external reproductive organs of male nd female are very distinct, the male having a large penis with well-developed horns. His mammary glands are rudimentary with very small ipples. Steinach found that after removal of the ovary in the female the ipples atrophied, and that after castration in the male the penis either id not develop, or, if the operation was performed after it had become eveloped, it underwent atrophy. He found further that implantation of esticular material into the castrated male restored the normal male haracterisation, and that implantation of ovarian grafts into the female estored the typical female sex-equipment. When he implanted testicular rafts into young ovariectomised females and ovarian grafts into young astrated males, he found that the male with no testes, but with ovarian rafts, developed large nipples, whilst its penis remained rudimentary. urthermore, such an animal permitted the approach of young and actually suckled them. In its behaviour it in no way resembled the normal ale. The female whose ovaries had been removed, and which had reeived testicular grafts, exhibited no female behaviour, but its clitoris eveloped into a penis-like organ.

Later investigators have found reason to qualify some of the original aims of Steinach, but that they are fundamentally correct cannot be oubted. One must conclude from this and similar work that the soma Gk. *soma*=body), the general tissues of the body, of either sex can develop either male or female characters according to the type of sex-ormone with which it is supplied. The soma possesses the potencies of eveloping the characters of either sex. This is not surprising to anyone ho is acquainted with the many forms which in Nature completely hange their sex. The sword-tailed minnow, a fish commonly kept by nciers, is remarkable in that many cases are known in which an old male has become a complete male. The oyster, it would appear, can ndergo complete sex-transformation year after year. Complete transrmation of male into female, and female into male, can be produced nder experimental conditions in the case of the gypsy moth. In quite number of forms, protandrous (Gk. *protos*=first ; *aner*=male) or progynous (Gk. *protos*=first ; *gyne*=woman) hermaphroditism is the rule, being usual for an individual first to function as a female or male, and en, later, as a male or female.

Manifestly, sex-reversal cannot be complete unless the component uctures of the sex-equipment of the individual are capable of becoming nsformed or else replaced. The ovary must be replaced or transformed into a testis, or vice versa. The accessory sexual apparatus, the externa organs of reproduction and the rest of the sex-distinguishing characters must be capable of being either replaced or remodelled. It follows, therefore, that sex-reversal cannot occur in any mature individual whose se organs are fashioned early in life and which thereafter lose all plasticit and become insensitive to any stimulus which, had it been exerted durin development, would have guided their differentiation. No more can i occur in any form in which the differences between male and femal architecture are based upon the differential development of two differen sets of structures, one of which in either sex undergoes, early in lif complete atrophy.

One would not expect, therefore, to find complete sex-reversal occurring in the mammal after birth. It is possible that it does occur in the cas of the bird. The evidence which exists is not conclusive, but certainly highly suggestive. If one removes the functional ovary of a hen, commonl the right sex-gland, which normally does not develop, springs into activit and develops into an organ which, in its microscopical structure, is somewhat like a testis. In the great majority of such cases, however, spermatozoa are not found in this organ ; but very exceptionally their presen therein has been recorded. Ovarian disease is relatively common amo those varieties of domestic fowl which have been selected for high e yield. A hen with an excellent record of laying ceases to produce egg her comb becomes as large and as erect as that of the cock of the bree and she begins to crow. If one makes a post-mortem examination of su a case one finds that in the place of the ovary there is a large vascul tumour (*i.e.* a tumour very rich in blood-vessels). In other cases, t plumage becomes entirely cocky in structure and colour and in the cases one finds usually that the left ovary has become entirely atrophie whilst on the right side there is a small sex-gland having the microscopical structure of a rudimentary testis. There are several instances of wh would seem to be complete sex reversal in the fowl, in which a hen, whi previously has been an excellent layer, rapidly assumes the male characters and actually fertilises the eggs of another hen. There must always a doubt concerning such cases, however, for the reason that though o has no cause to question the statements of the breeder, it is from him t the professional biologist receives his material ; so that the latter cann personally vouch for the accuracy of the statements relating to the earl part of the life history of the specimen.

If complete sex-reversal does occur, then it follows that it is due to t removal of the functional ovary by disease and to the consequent development of new sex-gland tissue, which assumes the structure of testes. C could easily explain the occurrence of sex-reversal in the fowl by an app to the hypothesis developed by Goldschmidt. If one assumes that dur embryonic life the female-determining reactions are effectively in exc in the case of the female fowl, then the sex-gland will be differentia under the influence of these reactions. The ovary develops and soon co to consist of something like 3,000 immature eggs. Ordinarily, during succeeding years of the individual's life these eggs ripen, and yolk is l down. So long as this ovary remains healthy, then its action will precl the operation of the male-differentiating reactions which, after embryo fe, have been increasing in efficiency; but if the ovary is removed by ie knife or by disease, then, should any further differentiation of sex-and tissue occur, it will take place under the influence of these male-fferentiating reactions which have overtaken and replaced the female-etermining reactions.

That the soma can, and does, react to both the male and the female x-hormone is shown in the clearest way by the case of the free-martin cattle. The free-martin is a genetic female (XX in sex-chromosome nstitution), whose reproductive system becomes abnormal during the eriod of the differentiation of the sex-equipment, as a result of the action the male sex-hormone of a normal male co-twin. Twins in cattle may nsist of two normal males, two normal females, one male and one male, each normal (this combination is exceptionally rare) or one male d a free-martin. Lillie, of Chicago, who finally solved this intriguing oblem of the nature of the free-martin, found that the great majority twins in cattle are fraternal twins and not identical. The two fertilised a pass into the uterus and become attached to its lining. As the zygotes crease in size, their embryonic membranes meet and in the great marity of cases fuse; so that if the after-births are examined, when the lves are born, it is a matter of the greatest difficulty to separate one set om the other. If such fusion occurs, it is possible for the blood-vessels each to ramify into the substance of the other, so that a common vaslar intercommunication may become established. It was noted that en the twins consisted of one normal male and one normal female, ere was no such vascular interconnection. If the twins are bisexual—at is, if one is a male and the other is a female—and if this fusion of the ıbryonic membranes occurs, and if the blood-vessels in them become njoined, any sex-hormone elaborated by one individual can pass into e body of the other. If then, the testis of the male should become funcnal at an earlier stage in development than does the ovary of the female, e male sex-hormone will be elaborated and will be pervading the tissues both fœtuses before the female sex-hormone is present. Under these cumstances, the female co-twin will pursue her development under the ection of the male sex-hormone elaborated by the testes of her brother.

Examination of the free-martin has shown that the assumption of the ale characters by the female twin is imperfect. The external reproductive gans are of the female pattern, whilst the internal organs of reproducn are more or less completely male. The sex-glands, which normally uld have become ovaries, assume the structure of imperfect testes. The gree of development of the mammary glands of the free-martin is as t of the immature female.

As has been stated, it is suggested that the female becomes abnormal ilst the male remains normal because the male sex-hormone is liberated fore the female sex-hormone is present. Of course, this is not the only ssible explanation. It may well be that the development of the sex-uipment of the male proceeds undisturbed by any influence exerted the female co-twin. Obviously, either the female does not exert any luence on the male, or else this influence is not strong enough to overne the tendencies toward male development as aroused by the male -hormone. It would seem that the former alternative is the correct one, for it has been found that the removal of the ovary during the early stage of development, for example in a one-day-old rat, does not in any wa affect the progress of the normal differentiation of the sex-equipment the female; whereas castration of the day-old male rat is followed by ver profound modifications. It would seem that the ovary does not exert an appreciable influence upon the soma before the individual has attaine a certain age, and that the sex-equipment of the female becomes develope because the impulse to this differentiation is innate in the soma of th embryo. In other words, the female type of sex-differentiation owes n thing to the female sex-hormone. This is not to say that when once th sex-equipment has been developed, it does not depend upon the fema sex-hormone for its maintenance. In contrast with this, the male type differentiation demands the presence of the male sex-hormone elaborate by the testis. A body without a sex-gland, or with an ovary, will devel the female sex-characters (in the case of the rat or mouse) : a body wi a testis will develop the male sex-characters. From the experiments whi permit these conclusions to be drawn, the fact emerges that the diffe entiation into a female is a function which every embryo can perform, long as no male sex-hormone is present to impose upon the body a ma type of differentiation. The female sex represents, in the early stages its development, the neutral form—that is, the form which the soma a sumes in the absence of the male sex-hormone. On the other hand, eve embryo would become a male if it were exposed during its early develo ment to the action of the male sex-hormone.

If this be so, it follows that in cases in which the male sex-hormo appeared in the body at a later stage of development than was usual, form of intersexuality would result, and that the degree of this inte sexuality, as measured by the amount of femaleness in characterisati would be an indication of the extent of the delay—the later the effecti production of male sex-hormone the more femaleness. It so happens th a great many cases of intersexuality, which would seem to be best e plained by an appeal to such an hypothesis, have been recorded. Th are common both in the case of man and of his domesticated animals. T typical history in these cases is that an individual regarded as a fem during the earlier part of its life later assumes many of the characters the male. In man, there are many cases known in which the individu having been reared as a girl, and even having become a wife, later und goes a strange sex-transformation. There are many cases in the goat which an individual has won prizes as a female kid and later has develop the beard and the head and the smell of a male. When the external productive organs of these cases are examined, it is found that though general they resemble those of a female, the erectile organ, which in female is quite small and hidden by the lips of the vulva, is over-lar whilst in the groin can be felt a pair of tumour-like bodies which, wh removed and examined, are found to have the structure of undescen testicles. When one examines the internal reproductive organs, one fi that in addition to a more or less well-developed uterus there are seminal vesicles, prostrate gland and epididimes, glands which either as store-chambers for the semen of the male or else add their own c tributions to his ejaculate (*see Fig.* 9).

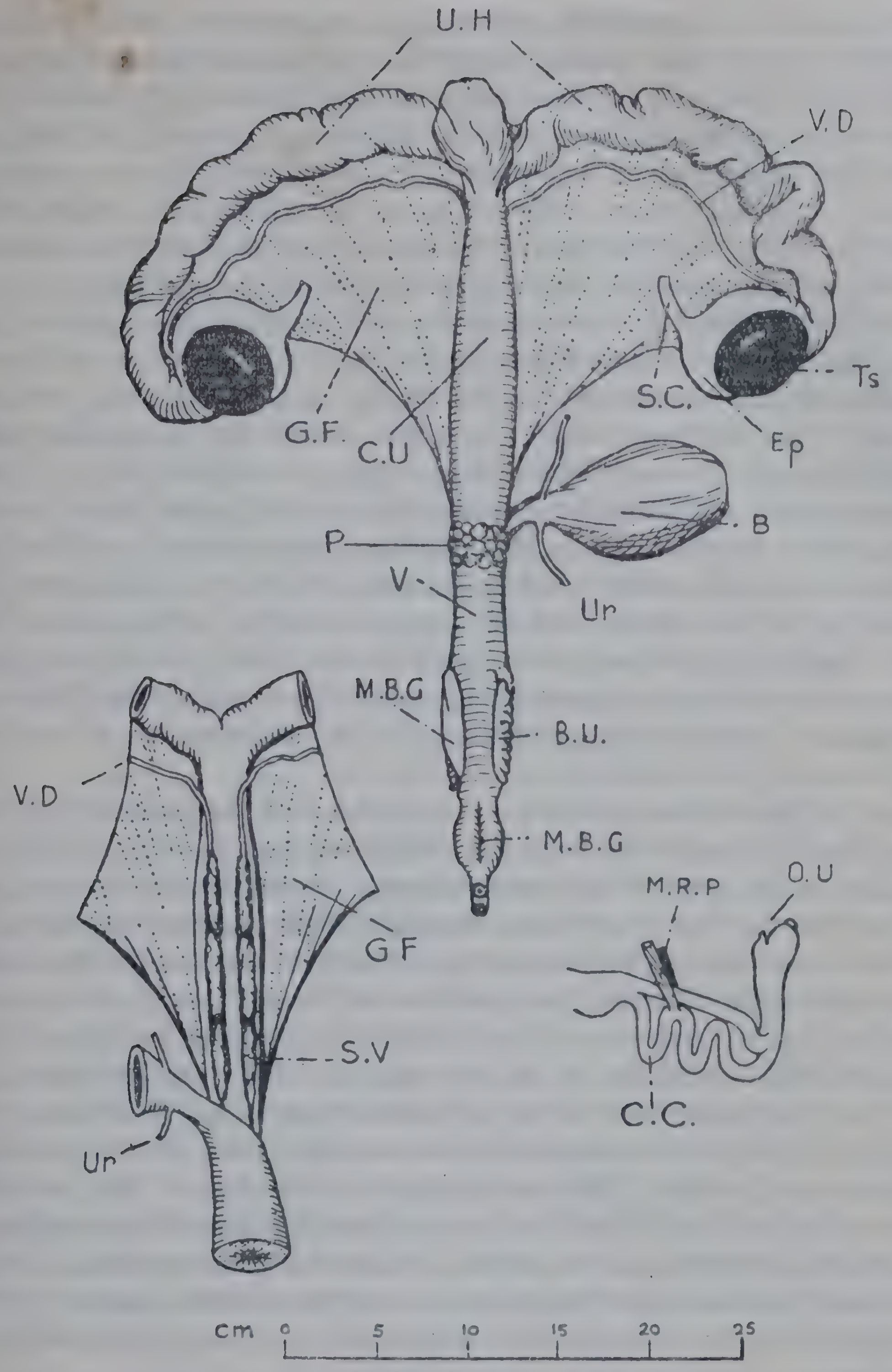

Fig. 9. A CASE OF INTERSEXUALITY IN THE PIG

B.	Urinary Bladder	both sexes
C.C.	Penis	male
C.U.	Body of Uterus	female
Ep.	Epididymis	male
P.	Prostate	male
S.C.	Spermatic Cord	male
S.V.	Seminal Vesicle	male
Ts.	Testis	male
U.H.	Uterine Horn	female
Ur.	Ureter	both sexes
V.	Vagina	female
V.D.	Vas Deferens	male

The animal's reproductive system consisted of an intimate mixture of male d female structures, but the sex-glands themselves were found to be testes.

In order to understand these cases, it is necessary to understand a litt about the origin and development of the reproductive organs. In th young fœtus, before the sex-characters are developed, there are to found two minute rudimentary sex-glands, or gonads, which posse neither the characters of the ovary nor of the testis. The accessory sexu apparatus consists of two pairs of ducts, one of which is called the Mi lerian, the other the Wolffian. The external reproductive organs cons of a cleft with a tubercle, the urogenital cleft and the genital tubercle. that individual which becomes a functional male, the gonads becor testes, the Wolffian ducts become the ducts of the testes which conv the spermatozoa therefrom to the penis, and the seminal vesicles a prostate. The Müllerian ducts atrophy, whilst the urogenital cleft a genital tubercle become the scrotum and penis respectively. In the ca of the female the gonads become ovaries, the Müllerian ducts become t uterine tubes and the uterus, the Wolffian ducts atrophy, whilst the ur genital cleft and genital tubercle become the vulvo-vagina and clitor At the time of the attainment of sexual maturity, in the case of man b tween fourteen and twenty-one years of age, many other sex-dimorph characters make their appearance ; *e.g.* differences in the degree of d velopment of the mammary glands, in the distribution of the hair, depth of voice and so on.

Now, in these abnormal cases it is found that the gonads have becor testes, that derivatives of both the Müllerian and Wolffian ducts becor well developed, that there is some degree of abnormality in the develo ment of the derivatives of the urogenital cleft and genital tubercle, a that those sex-dimorphic characters which are assumed later in life of the male type. These abnormalities can be explained, if it is assum that these individuals are males in their beginnings and that, owing a delayed differentiation of their testes, the male sex-hormone did come into play and control the differentiation of the Wolffian and M lerian ducts and of the urogenital cleft and tubercle. Before the male s hormone was present differentiation would be that of the neutral ty that is of the female. After it had come into play the differentiation wo be as that appropriate to the male. If there is a time seriation of events the sex-differentiation of these forms, then the degree of abnormality be determined by the time at which the male sex-hormone becor operative.

If this is so, then it can easily be understood how it is that an individu which is regarded as a female during the earlier part of its life, comes assume male characters after sexual maturity has been passed. The of an infant, or of a kid, is identified by reference to its external rep ductive organs. In the absence of the male sex-hormone, as has been sa the urogenital cleft and genital tubercle develop to assume a form wh is indistinguishable from the normal differentiated vulvo-vagina clitoris of the female. At the time of birth the genital tubercle is not ov large ; its size increases as the individual grows. The child is theref regarded as a girl and is brought up as one. It is unlikely that any rea will present itself for examining further the external reproductive org of such a child. At the time of, and after, sexual maturity the superfi sex-dimorphic characters become expressed, and at this time, if amination were made, suspicions would quickly be aroused. It would found, for example, that the distribution of the hair on the body and e size of the clitoris were not in accord with the typical female plan, it such examination is not made until, as usually happens, persistent in in the groin, together with the growth of hair on the face, sends e individual to a doctor.

In other cases of this kind a further abnormality is noted. The sex- ands, instead of consisting solely of testicular tissue, take the form of o-testes, which include both ovarian and testicular material. These are ses of what is commonly known as "glandular hermaphroditism" *e Fig.* 10). Usually the testicular material contains no spermatozoa, t an abundance of that tissue which is known to be the source of the ale sex-hormone. It is an interesting fact that the testis cannot elaborate ermatozoa if it is retained within the abdominal cavity. The reason for is would seem to be that the temperature within the abdomen, being veral degrees Centigrade higher than that within the scrotum, is too gh for the processes of spermatogenesis to proceed normally. In order explain these cases, it is necessary to call upon the hypothesis adum- ated by Goldschmidt to account for his cases of intersexuality in the psy moth. These would seem to be individuals in whom there is a dis- rmony between the male- and female-determining factors in the here- ary constitution. If, for example, during the time of the differentiation the gonad, first the female-differentiating reactions are effectively in cess, and if almost immediately these are supplanted and replaced by e male-differentiating reactions, then the gonads will become an inti- te mixture of ovarian and testicular tissues. If the elaboration of the le sex-hormone on the part of the testicular tissue is somewhat delayed, ere will result an intersexual condition of the accessory sexual apparatus d external reproductive organs, and when the development of the rivatives of the Müllerian and Wolffian ducts has been completed, the ferentiation of these structures will be maintained by the male sex- rmone and by the female sex-hormone provided by the mixed sex- nds. Furthermore, the remaining sex-distinguishing characters, which pend for their expression and maintenance upon the sex-glands, will developed under the influence of both ovary and testis and thus a sex saic, an individual with the characters of both sexes, will be produced.

THE PSYCHOLOGICAL ASPECTS OF SEX

The older psychology either disregarded sex altogether or, where it alt with it, tried to bring it into line with the usual classification of the otions. In recent years the scientific study of sex-behaviour has been dertaken, and into this particular problem the conception of the reflex chanism has been introduced. These reflexes are mechanisms which y a very important rôle in a great many of the functions of the living ganism. An example which one may display for oneself is that which is own as the knee-jerk. By sitting with one leg resting upon the other, h both knees bent and the muscles relaxed, and by striking with the ge of the hand just below the knee-cap of the upper leg, one will notice t this leg gives a sudden kick. Consciousness is not involved in this

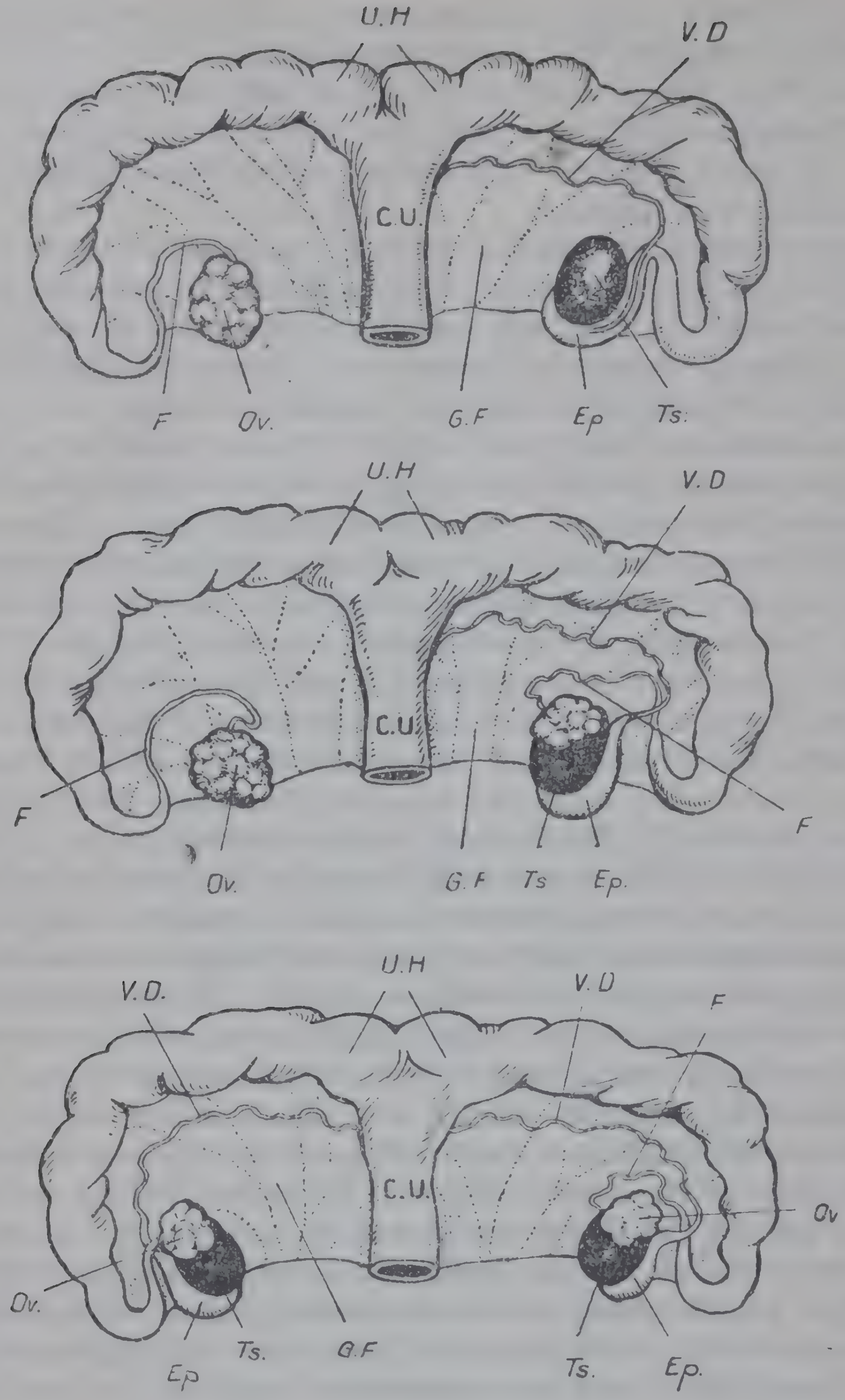

Fig. 10. DIFFERENT TYPES OF "GLANDULAR HERMAPHRODITISM" ENCOUNTERED IN A PIG

C.U.	Body of Uterus
Ep.	Epididymis
F.	Fallopian Tube
Ov.	Ovary
Ts.	Testis
U.H.	Uterine Horn
V.D.	Vas Deferens

ction. What really happens in this series of events is that the sudden blow
the tendon of the knee-cap involves the stimulation of the sensory
erves therein. Along these the message is passed to the spinal cord,
here it is, so to speak, switched-over to associated motor nerves, along
hich passes the complementary message which provokes contractions
certain muscles of the leg. Now, the essential feature of this so-called
flex arc and its functioning is its entire independence of consciousness
d deliberation. Many are the reflex actions of this kind, and without
ubt they are of the greatest importance to the organism. The blinking
the eyelid if a speck of dust or any other foreign body touches or
reatens to touch the eyeball, the coughing that follows immediately
on the irritation of the back of the throat, the sudden withdrawal of
e hand when it touches unexpectedly something hot or very cold, the
ap for safety out of the way of the on-rushing motor-car—these are all
stances of reflex actions, which may be so important to the individual
to make all the difference between living and dying.

In the case of insects, behaviour can be simply and generally explained
a complex of reflexes which are predetermined in the structure and in
e organisation of the animal. For example, there are caterpillars which
variably, when moving, crawl in Indian file, one behind the other ; the
st one being directed in its movements by certain conditions of the
rface of the body on which it seeks its food. All the rest follow strictly
the train of the first. Should one force the first caterpillar to cross its
vn trail, then it will follow that trail and the whole procession will move
ntinuously in a circle, even though in doing so they can never reach
eir object and inevitably must starve. Practically every kind of behaviour
the insect can be explained by reference to some reflex action. It flies
ward a flower, not because it wants to do so, but because it must. The
wer excites certain sensory nerve-endings, and these in their turn in-
te the movements of those muscles which, in their action, direct the
imal toward the flower.

It might seem at first sight that in this matter of reflex action one can-
t compare an insect with the higher mammals, but it can be shown in
e case of those animals which are available for experiment, and which
ust be regarded as being essentially similar to man in respect of their
haviour, that reflex actions such as exist in the insect also operate in
em. For example, appropriate stimulation of the male ejaculatory organ,
of the female genital region, produces a state of general sexual excite-
ent which can lead to the climax of the sexual act, ejaculation in the
se of the male and contraction of the uterus during an orgasm in the
male. The chain of these reflexes has been investigated, and it is now
own that the stimulus applied to the genital region provokes a nervous
action which is conducted to the lower part of the spinal cord, where it
ks up with motor centres, and that nervous stimuli sent therefrom lead
the contraction of the muscles surrounding the deferent duct of the
stis, thus producing ejaculation in the case of the male and, in the
male, to a contraction of the muscles of the uterus. In the case of the
inea-pig boar, if one places an electrode to the tongue and another to
e skin of the neck and then releases a slight electric shock, the animal
ll behave exactly as it does during the act of sexual congress, there

being erection of the penis and complete ejaculation, although no femal and none of those stimuli which normally call forth sexual excitement ar present. The explanation for this behaviour is that the electric curren directly excites the motor centres in the spine which normally are stimulated by messages received by way of the sensory arms of this reflex arc and this leads to exactly the same effect as does the presence of a femal in heat. It has also been shown experimentally, that even after removal o those portions of the brain which are known to be concerned with th higher psychical functions, this electrical stimulation produces exactl the same result. It follows therefore that erection and ejaculation in th male and contraction of the uterus in the female, phenomena which ar the most prominent features in the act of sexual congress, are refle actions and are not under the control of the brain.

The reflex nature of the sex act has been demonstrated in the cleares possible fashion in certain of the lower forms of life, for example, th garden snail. It has already been mentioned that the sexual organisatio of the snail is complicated. There is only one kind of individual, each ha both ovarian and testicular tissue and each produces both ova and spermatozoa. Nevertheless, two individuals mate and during this proces they exhibit very intricate movements and seem to express very considerable excitement. Yet one can show, in the simplest fashion, that th whole chain of events is dominated by simple reflexes. If one shoul stimulate certain regions of the body surface in an orderly sequence, on can produce in a single snail, in the entire absence of any other individua all the expressions of the sex act in exactly the same sequence as thes occur during normal mating. It is a long way from snail to man, and certainly in all forms it is not so simple a matter to demonstrate the chain o reflexes and complexes which constitute the complete performance of th sex act. But there is no doubt that whilst stimuli which are not of a tactil olfactory or visual nature have yet to be investigated, it should be possible in the future to interpret the whole sexual behaviour exhibited b the higher forms as a series of reflex actions.

So far, only the act of sexual congress itself has been discussed, bu observations have been made which show quite clearly that sex-behaviou in the wider sense of the word, is no less reflex in nature than is the actu sex act itself. In the rat, for example, one notes that sexual behaviour i the case of the female is restricted to certain periods—the periods o œstrus (Gk. *oistros=gadfly*) or heat—which recur following intervals o four to six days. The male, on the other hand, is always prepared to exhibit sexual activity. There are two entirely different kinds of respons on the part of the female to the advances of the male, according to whethe or not she is in heat. If she is not, then she replies to the approach of th male with very definite movements of defence, making copulation impossible for mechanical reasons. She simply will not receive the male. Bu later, when she comes in heat, this behaviour changes completely, an on the approach of the male she crouches, arches her back and thus make sexual intercourse possible. But a female rat which is in heat will no only crouch on the approach of a male, but can be induced to do so i response to very different kinds of stimulus. If, with one's fingers, on should press upon her back, she will adopt the mating position. Thus

pears that we are dealing with another example of a reflex action, one
iich does not occur at any time but only during the heat period. It
ay be said that the main feature of œstrus, or heat, is that during this
riod the mating reflex can be exhibited by the female. It matters not by
iat the stimulus is exerted : it may be a male or it may be the pressure
the human finger. During this time, if this particular stimulus is ex-
bited, the response is inevitable and is not under the control of the will
the rat.

In the case of the male, whilst there is no reason to assume that a
nilar kind of mechanism is not involved, it is probable that the
echanism is rather more complicated. It would appear at first sight
at the stimulus which releases sexual desire in the male is the smell, or
e sight, of the female. However, males which are blind, which have
en robbed of their sense of smell, whose cutaneous sensations have all
en obliterated, and which are deaf, nevertheless can perform the sex
t as readily and as efficiently as does the normal male. It follows, there-
re, that it cannot be the smell, or the sight, or the noise made by the
nale which evokes the exhibition of sex behaviour on the part of the
ale. One has to conclude from all the observations which are available,
at there is automatism in the male which leads to a continual urge to
rform the sex act. The actual performance of the male during sexual
ngress is nevertheless conditioned by the behaviour of the female, and
culation does not take place until the female has permitted the male to
ount her. So it would seem that the male endures a continual urge to
rsue and mount the female, and that as soon as the latter permits him
do so ejaculation occurs as a reflex act. If this be so, we are dealing
th a chain of reflexes which, in their functioning, are conditioned by
e occurrence of reflexes in another individual. Manifestly, such mechan-
ns may be very complicated. If they exist in the case of man—and
ere is no reason to assume that they do not—then in all probability the
nsory stimuli must be largely presented by the physical attractions of
e heterosexual partner ; these, in their turn, being qualified by all sorts
inhibitions and preferences born of social experience. However, the
plication of the concept of the reflex arc to the problems of sex-
haviour has placed future research in this particular field on a firm
sis. This has made it possible to exclude the influence of consciousness
an active factor in matters of sex, and to regard consciousness as a
ore or less additional phenomenon.

The study of reflex mechanisms in relation to sex-behaviour leads in-
itably to a consideration of the nature of the attraction that one indi-
dual can exert for another. It is the rule that it is the male of the species
iich exhibits the desire to mate, which pursues the female. But this is
t essentially a male characteristic, and it can be shown that it is not
e presence of the testis which determines this form of activity. There
e species in which the male is inactive and in which the female plays an
ive rôle in courtship. Among birds, for example, in the case of the
alarope it is the female which wears the brighter plumage and plays the
ive rôle in courtship, though amongst breeds generally the adornment
the male far surpasses that of the female, and it is the male which is
one to exhibitionism. But these exceptions to the rule show clearly that

sex-behaviour is by no means necessarily related to the production of spermatozoa or ova, and that the psychological sexuality of an animal may be quite different from physical sexuality. This fact has given rise to considerable speculation, and has encouraged certain experimentation relating to the condition of homosexuality in man.

Homosexuality has been regarded as the state in which an individual, equipped with all the physical characters appropriate to one sex, exhibits the psychological characters appropriate to the opposite sex. Thus a homosexual male was looked upon as being psychologically female, though structurally male. It was but natural that against the background of our knowledge of the relation of the endocrine glands and the sex characters, it should be assumed that this homosexuality was to be attributed to the secretion on the part of the gonad of the wrong sex-hormone ; that is to say, that a testis, instead of elaborating male sex-hormone, was producing female sex-hormone, and vice versa. Steinach concluded from his studies that the male homosexual had an abnormal testis of this kind, and argued that the cure of homosexuality must take the form of the replacement of the testes of the patient by others from a normal heterosexual male. Clinical records seem to show that in this way homosexuality could indeed be cured ; but there is reason to think that this experimentation and its clinical application were erroneous, both in conception and in the recorded results. It is well known that the human subject is a very unsatisfactory experimental material. The patient himself rather complicates the experiment by allowing opinion and self-interest to colour his symptoms, and his examination can never be sufficiently objective. Moreover, it is commonly forgotten that there is no real reason why the homosexual should be essentially different from the heterosexual It is well known that the male of domesticated animals, under certain conditions, very frequently attempts to perform the act of sexual congress with other males. If twelve cocks are kept together, in the absence of females, it is certain that some of these males will be treated by the rest as though they were females. Homosexuality does not consist so much in differences in male behaviour as in the choice of unusual objects. If the appropriate object is absent, or if the individual is unable to identify the proper sex of the object, then copulation will be attempted, but it will be successful only if the partner is the female. It would seem, therefore, that homosexuality is not so much due to a disturbance in the secretions of the endocrine (Gk. *endor*=within; *krinein*=to separate) glands, but rather to a disturbance of the central nervous system which results in the choice of an unusual object for the purposes of mating.

At this stage we must return once more to the sex-hormones. Thus far we have discussed the influence of these upon the structural and physiological characters of the individual, but it can be shown that their influence upon the psychical characters, as expressed in sex-behaviour is no less pronounced. The female rat from which the ovaries have been removed no longer shows that periodic recurrence of heat which is typical in the case of the normal rat. In respect of sexual behaviour she is indeed asexual. For her life is but one long " interval," no mating is ever observed. On the other hand, should one inject the female sex-hormone which leads once again to the development of the genital organs, one finds

at the injected female again exhibits sexual behaviour. The animal
ich has received a sufficient quantity of extracts containing female sex-
rmone behaves exactly as does the normal female rat during the period
œstrus. It responds to the approach of the male with the typical mating
lex. It is obvious, therefore, that the sex-hormone erotinises the ner-
us system and this creates what one might call the psychological con-
ion of sexual activity. As yet we have no knowledge as to the method
which this state of erotinisation is actually produced, nor of the changes
the nervous system created by the hormone. Nevertheless, it can even
w be stated that the mechanism which is concerned with sex-behaviour
s been disclosed, and that the exhibition of this mysterious urge, con-
ning which mankind has speculated for centuries, can be called into
ing by the administration of a substance, chemical in nature, the
ual composition of which will soon be known.

In the case of a male the facts are somewhat different. If one removes
ovary from a female rat, sexual activity is immediately obliterated.
the male, on the other hand, this only occurs if castration is performed
ore the individual has reached sexual maturity. This is not true only
the rat, for it applies also to man. It has frequently been described
w men who have been castrated before they have reached puberty have
ver developed the sex-characters of the male, but that if castration
urs in adult life, sex-characters and sex-behaviour are not thereby
npletely destroyed. It follows, therefore, that the erotinisation of the
vous system which occurs at the time of puberty persists in the case of
male for a longer period of time than it does in the case of the female.
t it can be shown that this again is due to the action of a sex-hormone,
his case, the male sex-hormone, which, as has been shown, is respon-
le for the expression and maintenance of the physical sex-characters of
male. If one castrates a guinea-pig the seminal vesicles, which pro-
e the bulk of the fluid in the ejaculate, atrophy, and though erection
y still occur, ejaculation is impossible, since there are no spermatozoa
l no secretion from the seminal vesicles. After a time the power of
ction of the penis also disappears and the sex-urge becomes greatly
inished. However, injection of the male sex-hormone restores this
-behaviour and the power of erection, and should one now apply the
trical stimulus to which reference has already been made one notes
t the guinea-pig responds with a complete ejaculation.

he psychological effects of these sex-hormones are not restricted to
field of sexual activity as ordinarily understood. Rats that are kept for
oratory purposes are provided with revolving cages, in which they
e their exercise. It is to be noted that the rat is a very active animal,
that if a contraption like a cyclometer of the ordinary push-bicycle
ttached to the revolving drum, they spend hours in this drum and
el for miles at a time. It has been found that this spontaneous ac-
y of the rat is an indication of the individual's sexual activity. For
nple, in the case of the female, the animal about to come in heat takes
more exercise than she does in the interval between two heat periods.
r ovariectomy there is a remarkable diminution in the amount of this
ntaneous activity, but should such an ovariectomised female be
cted with the female sex-hormone, then her spontaneous activity is

raised again to the normal level or even beyond it. The same is true of male. If we tried to translate these findings into ordinary language, might be inclined to say that the animal which exhibited a high degree spontaneous activity was a very energetic animal, and the animal wit low spontaneous activity a relatively lazy animal. It is an interest thought that the degree of this activity is related to the intensity of sexual urge. The tendency to go hiking, to indulge in Rugby football, violent games of tennis, the running round and round in a revolving ca these all would seem to be of the same order, and laziness and activ would seem to represent the reaction on the part of the nervous system those chemical agencies, the sex-hormones.

It is necessary to make an attempt to link up these facts and suggesti with certain of the statements of modern psychology, particularly psycho-analysis. The psycho-analytical point of view is that the prim source of mental energy is represented by the sex-urge, which can directed to other purposes during the course of individual developm and ordinarily is so transferred.[1] It must be the purpose of future inv tigation and of theoretical analysis to examine the possibility of int preting physiological findings such as have been discussed in psycho gical terms, but attention should now be drawn to the fact that in the c of the experimental animal, at least, the sex-hormone is the creator sexual energy in the strict sense of the word as well as of general activ and that, in addition, these hormones are intimately concerned with expression of the higher functions of the nervous system.

The maze is a favourite instrument of the experimental psycholog Rats have mostly been used for these experiments, and the task set th is to find their way to an inner chamber where food is offered. number of trials and errors until the individual passes directly and with hesitation to the food is registered as the measure of the learning abi of the rat. It has been found that the supply of sex-hormone is a facto great importance in the degree of learning ability exhibited by any ticular rat. The female sex-hormone increases the ability to learn w it is given in certain concentrations, whereas the absence of the fem sex-hormone decreases the ability to learn just as it decreases the amo of spontaneous muscular activity. It is not extravagant, therefore suggest that future developments in this field of research will lead most far-reaching consequences, inasmuch as mental development se to be so very dependent upon the proper supply of the sex-hormone follows that if this is so, then when these hormones are available in and simple form it should become possible to control the developmen the mind through their use to an extent far beyond that which i present imagined by the orthodox psychologist, who, after all, deals with the product of the reaction and not with the reaction itself.

It is profitable to approach this subject from the opposite angle, an enquire how far sexual activity and the act of coitus affect the gland internal secretion. This system of glands, which includes the thyr pituitary, adrenal, ovary and testis, consists of organs which elabo specific products of a chemical nature, hormones, which pass by

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[1] For a fuller treatment of this subject, see the Article on *Psycho-Ana* p. 373.

ood stream throughout the body. There can be no doubt that, in some
rm or other, these ductless glands are influenced in their functioning by
e expression of sexuality. As yet but little is known of this subject, but
inkling of the facts may be gleaned from a consideration of the relation
ich undoubtedly exists between sexual activity and the functioning of
e pituitary, a small gland which lies at the base of the brain.

Medical men have known for a long time that certain types of disease
d degeneration of the pituitary are accompanied by an imperfect de-
opment of the reproductive organs—there is a diseased state known as
uitary infantilism. Extirpation of the pituitary in an otherwise normal
lividual leads to atrophy of the testes, and therefore to an atrophy of
ose sex-characters which depend for their maintenance on the supply
the male sex-hormone. Furthermore, implantation of the anterior lobe
he pituitary in such animals leads to the repair of the testes, and there-
e to a re-development of those sex-characters which are dependent
on the gonad. The same is true of the female. Furthermore, if one
lants small pieces of the anterior lobe of the pituitary or injects pre-
red extracts of this lobe into sexually immature animals which nor-
lly would not reach puberty for a considerable time, one finds that
ost immediately the changes characteristic of puberty appear. Thus it
hat young mice, being so treated, come rapidly into heat and their
ries show mature ova, whilst the testes of young males similarly
ated pursue a greatly hastened development. Male sex-hormone is
orated, and this incites a rapid development of the penis and of the
er male sex characters.

t is seen from this and similar experiments that the function of the
nad, which controls the development of the sexual characters, is not an
omatic one, for it depends upon the presence and action of a hormone
orated by the anterior lobe of the pituitary. It follows, therefore, that
anterior lobe of the pituitary is as much the spring of sexual activity as
the gonads, even if not more so. But it must be recognised that the
-differences exhibited by male and female cannot be due to the action
the pituitary itself, for this gland secretes the same hormone in the
le as it does in the female, and the differences are due to the fact that
he male the pituitary hormone activates the testis whilst in the female
ctivates the ovary.

he intimate interrelation between pituitary and ovary can be illus-
ed by reference to the state of pregnancy. It has been shown that in
lition to the female sex-hormone which is elaborated by the ovary,
is responsible for the expression of the physical and mental charac-
, which in their combination constitute œstrus, or heat, another
mone is secreted by the ovary. It is known that after mating the
rus of the mouse and the rat undergoes certain changes which make
gnancy possible. Its lining membranes become thickened to form a
, in which the fertilised egg may become implanted, and later to take
t in the formation of the placenta, or after-birth. Now, these changes
he uterus occur under the influence of an ovarian hormone, probably
orated by the corpus luteum, that is very different in its nature from
female sex-hormone. (The corpus luteum, or yellow body, consists of
ndular tissue, yellow in colour, which develops in the scar on the

surface of the ovary after the rupture of the ovarian follicle and t escape therefrom of the ovum.) Therefore, the ovary, through these tv hormones, controls not only sexual activity but also reproductive a tivity. In the rat, for example, the secretion of this second, pregnanc promoting hormone does not begin until immediately after mating : th is to say, the preparation of the uterus for the reception of the fertilis egg by means of the action of this second hormone does not begin un immediately after insemination and fertilisation. The sex act itself brin about a very definite change in the hormone function of the ovary, a this in its turn leads to the development of markedly changed conditio in the psysiological and psychological state of the individual.

Now, these changes can be brought about artificially. A rat will e hibit all the features of pregnancy if, during the period of heat, the ne of the uterus is stimulated by means of a fine glass rod. One must assum therefore, that mating leads to the stimulation of certain nerve endings the neck of the uterus and that along these sensory nerves are pass messages which ultimately affect the functioning of the anterior lobe the pituitary, which then proceeds to produce a second hormone a this affects the ovary, calling forth the second ovarian hormone whic acting upon the genital tract, stimulates this to develop the conditions pregnancy.

This account may serve to illustrate the very intimate interrelationsh that exists between the various members of the system of endocri glands, and how several of them are not only directly concerned in t expression of the physical and physiological characters that pertain sex, but also how they would seem to lie at the basis of much that is present claimed as the peculiar possession of the psychologist. It may expected that further investigation will show that quite commonly the is an understandable physical basis for that which one is wont to cal purely emotional phenomenon.

THE SEX-RATIO

The sex-determining, sex-chromosome-distributing mechanism shou lead to the production, in the case of a bisexual species, of equal numb of males and females in each new generation, for the reason that the t forms of gametes elaborated by the digametic sex should be produced equal numbers. The primary sex-ratio—that which obtains at the time conception—should therefore be equality. There should be 100 males p 100 females conceived. If this primary sex-ratio is not equality, then must conclude that either the two forms of gametes are not produced equal numbers or else that one is more successful in the act of fertilisati than is the other. Observations that have been made demand for th explanation that certain individuals do indeed produce more of one ki than of another, and experiment has shown that it is possible to influer the proportion of the two kinds produced.

Thury, in 1863, developed the theory that an ovum fertilised soon af extrusion from the ovary tends to produce a female, whilst an older ov will later develop into a male. This theory has been incorporated i the practices of breeders of domesticated animals, and indeed statisti

nvestigations undertaken by Pearl and his colleagues in America
eemed to show that possibly the theory was correct. They found that, in
ie case of cattle, the sex-ratio amongst calves which had been conceived
uring the earlier part of the period of heat of the mother was signi-
cantly different from that of calves conceived during later periods.
Iowever, further figures collected by the same investigators showed that
nis conclusion was not tenable. But that over-ripeness of the egg, such as
ight result from delay in fertilisation, is associated with a swing in the
x-ratio is shown by the work of Hertwig and his pupils. The female
og only lays her eggs whilst the male is on her back, exhibiting the
ating reflex. A male frog was allowed to fertilise half the eggs extruded
a female and was then removed, and after varying intervals of time
as replaced and allowed to fertilise the remaining half. It was found that
ith increasing intervals more and more males appeared amongst the
fspring, so that after an interval of 89 hours between the fertilisation of
e first and the second half, none but males were produced. It was shown
at this was not due to any sexually selective mortality, and that the only
planation that can be given is that the over-ripe egg when fertilised
evitably becomes a male, whether it is fertilised by an X-chromosome-
earing sperm or by a Y-chromosome-bearing sperm.

If the primary sex-ratio were equality, but if a sexually selective pre-
tal mortality operated, then the secondary sex-ratio—that which
otains at the time of birth, or hatching—would be more or less removed
om equality according to the intensity of this pre-natal mortality. In the
se of man it is known that more boys than girls are born: the secondary
x-ratio for Great Britain being roughly about 103 : 100. Thereafter, in
ery age-group save those which include the onset of menstruation and
the climacteric in the female, the death-rate is higher amongst the
ales; so that amongst the people in Great Britain who are 80 years old
older there are about 2 women for every man; that is to say, that
ring post-natal life there is sexually selective mortality operating which
duces the sex-ratio at birth of 103 : 100 to one of 50 : 100 amongst the
e-group 80 or over.

It will be found on examination that the sex-ratio amongst still-births—
at is, amongst infants born dead at or about full-term—is distinctly
gher than that amongst children born alive. This means that still-birth
more common amongst boys than girls. The sex-ratio amongst abortions
that is, amongst fœtuses born dead between the time of conception and
e seventh month of pregnancy—is again higher than the sex-ratio of
ll-births. It is impossible to identify the sex of the fœtus before the
ird month of pregnancy, but such figures as are available seem to show
at the sex-ratio is highest amongst abortuses of the third and fourth
onth, and that thereafter it declines in a steady fashion to blend with the
condary sex-ratio of 103 : 100.

It follows, therefore, that, in the case of man, a sexually selective mor-
ity is operating both before and after birth. It also follows that if the
condary sex-ratio is 103 : 100, in all probability the primary sex-ratio
not less than 150 : 100. Far more boys than girls are conceived, but
more boys than girls die before they are born. It is difficult to offer any
equate reason to explain this fact. All that can be suggested is that

whilst sex-linked recessive characters, that are lethal or semi-lethal
their effects, could account for some of the mortality amongst the males,
is impossible to call upon these agencies to explain the whole. All that c
be said at the present time is that the male would seem to be less able
withstand unfavourable conditions. It is certainly true that amongst tho
peoples who take parentage seriously (the Jews, for example) the seco
dary sex-ratio is higher than that of other sections of the same communi
It is probable that the present developments in ante-natal and chi
welfare practices will lead to the raising of the secondary sex-ratio.

CONCLUSION

A survey of the facts and of the fancies that have been presented e
ables us to express certain reasonable expectations. The problem of t
control of sex-determination and of sex-differentiation is one that i
trigues many minds. According to many the problem has already be
solved. Almost every year there appears a book or a pamphlet written
someone—never a professional biologist—who claims to have found t
key to this particular riddle. More commonly than not they have red
covered that which Rumley Dawson thought he had discovered, and t
theory, which underlies the practices which they advocate, demands t
in the case of man and his domesticated animals the female and not t
male shall be the digametic sex. The usual form of the theory is that t
two ovaries differ one from the other in that one produces eggs whi
being fertilised, are destined to become males, the other producing e
which are destined to become females ; and that the ovaries funct
alternately with succeeding heat or menstrual periods. If, then, one no
the sex of the first offspring and is able to relate the conception associa
with the pregnancy that produced this to a particular menstrual period
period of heat, one is thus enabled to predict the sex of any subsequ
offspring.

Another variant of this theme is that the ovaries, one being ma
producing and the other female-producing, function synchronously a
that the sex of the offspring is determined by the direction of the flow
the male ejaculate. Thus is it that breeders have their cows served on
slope of a hill, one flank being lower than the other. The semen of
male is supposed to drain toward the lower flank and therefore ens
fertilisation of an ovum elaborated by the ovary on this side.

There is no doubt that statistics can be collected which comple
prove the correctness of these theories, or, on the other hand, dispr
them. In any case, any discrepancy can most easily be explained by re
ence to faulty observation or to a temporary abnormal functioning on
part of the two ovaries. The fact remains, however, that these theor
attractive as they are, cannot be brought into line with established sci
tific fact. Biology has shown that it is not the female of the mammal
the male that is digametic, and that the problem of the control of the
of the individual that is to be will only be solved when it has been fo
possible to ensure that fertilisation is affected by one or other kind
sperm. It is possible that the two kinds of sperm might be separate
they were forced to travel through an artificially produced chemical f

the vagina of the female, one kind being more or less completely im-
obilised. But so far no experimental application of a physical or chemical
ent has succeeded in separating the two forms. If and when such separa-
on is affected, then of course it should become eminently possible to
sure that the result of fertilisation shall be male or else female.

The future is full of promise, for with developments in our knowledge
the endocrine basis of sexuality it should quickly become possible to
ntrol the expressions of puberty and of senility, due to breakdowns in
e hormone function of the sex-glands and of the pituitary. Since dis-
rmonies in the functioning of these glands of internal secretion are
sponsible for so much personal and social misery, control such as is
visaged could prove of the greatest benefit to mankind.

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PSYCHOLOGY

By

F. AVELING

SYNOPSIS

Rise of psychological problems in prehistoric speculation; animism — Gradual emergence of distinction between living creatures and inanimate beings; between life and mind — Position of psychology in Greek philosophy; soul and body, dualistic views (Plato, Aristotle) — Freedom and determinism — Importance of psychology in early Christian thought; emphasis upon the human soul, its nature, origin and destiny (Augustine) — Development of psycho-physiological and psychological doctrines in mediæval Scholastic philosophy; intellect and will (Aquinas, Scotus) — Renaissance and post-renaissance period — Theories of interaction between soul and body (Descartes); of parallelism; of monism; of panpsychism (Leibniz) — Beginnings of empirical psychology (Locke) — Laws of association and associationism (Hume) — Development of contemporary psychology under the influence of the theory of evolution (Darwin, Spencer) — Emotions and behaviour — Individual differences (Galton) — Comparative psychology; study of the behaviour of lower animals, primitive peoples and young children — Physiological psychology and experimental psychology (Wundt) — Social psychology (McDougall) — More important contemporary systems of psychology; Behaviourism; Psycho-analytic schools; "Gestalt" psychology; Noegenetic, or Two-factor, school; dynamic psychology and personalism — Applications of psychology to problems of life and living; education; medicine; industry and commerce, etc. — Definition of psychology.

PSYCHOLOGY

INTRODUCTION

Psychology is still a science in the making rather than a finally established one. This is indicated by the lack of agreement among psychologists upon the exact definition of the subject. There are a number of contemporary schools in existence, each advocating its own particular principles and methods and defining psychology in its own way. It is thus presented as the science of the soul, of mind, of consciousness, of behaviour, and the like. And this is not astonishing when we remember the extraordinarily varied interests of psychologists to-day. They cover so wide a range, and involve so great specialisation, that many points of view are inevitable. There is, however, more real unanimity than might appear on the surface ; since, with negligible exceptions, all would agree that the principal subject-matter of psychology is human conduct ; that it is concerned with conduct in order to discover the principles which account for it, and so be in a position to control and guide it ; and that the methods to be employed in the study are the observation of behaviour, on the one hand, and introspection or the inner observation of our own conscious processes, on the other. All the definitions, though apparently exclusive, can be reduced to a single formula. Psychology is the science which investigates behaviour in general from the point of view of its mental implications, whether conscious or unconscious, with a view to control.

To appreciate the present state of scientific psychology it will be useful to review the outstanding points in its historical development. It is the last of the sciences to have broken away from philosophy ; and it still raises acute philosophical problems at every turn. Solutions of these problems have been offered by a succession of great thinkers, in which we find a progressive clarification, each advance marking a higher achievement than the preceding one. But almost from the outset we discover indications of contemporary systems. The central problem, towards which all the others converge, is and always has been that of the nature of man as shown in his various activities, and particularly those of feeling, thinking and willing, so far as they account for human conduct. The history of psychology, accordingly, will be an account of the ways in which conduct has been interpreted, and of the different conceptions men have framed of themselves as actors in the drama of life. It could have no beginning until the observation that such conduct differs radically from the behaviour of inanimate beings, and in many essentials also from that of animate creatures other than human, had provoked reflection upon the reason why this should be so. From the very origin of the human race man has presumably been a self-conscious animal ; but there could have been no psychology, even the most rudimentary, until he came to reflect upon his own self-consciousness and attempt some explanation of it.

PREHISTORIC THOUGHT

It has been assumed that psychology originated in the thoughts of primitive men about the phenomena of sleep, dreams, insanity and death. These would lead to belief in the existence of impalpable counterparts of the bodies of the living, which were capable on occasion of severing their connection with the body, and at death finally departed from it to live on as ghosts in an underworld. Proof of this for the primitive mind would lie in the fact that the inert body of the sleeper awoke to report dream adventures in remote places and times, and to recount his meetings and transactions with people already dead. Further proof would be found in the phenomena of mental disease, which would point towards possession of the body of the sufferer by conscious agents other than himself, by demons, ghosts or forces able to control its actions even against his will. The conscious wraith, wandering abroad in sleep and disappearing at death, would be held to inhabit the body during life, and to account for the latter's vital actions, movements, feelings, thoughts and desires. The assumption presupposes considerable reflection already on the part of primitive man ; and it is probable that it was preceded by a stage of development in which no distinction was made between animate and inanimate beings, but all were thought of as possessing hidden activities similar to those of man himself. In this stage, by an analogical interpretation of Nature in the light of the primitive's own experience, everything would be regarded as endowed with conscious life, and able to play its kindly or malevolent part in human affairs. Until this stage had been outgrown, and distinctions between conscious and unconscious beings recognised, there could be no beginning of science, either physical or psychological. There is evidence of a phase of animism (the endowing of physical objects with consciousness) which precedes the distinction of living from inanimate beings in the developing mind of the very young child which, according to the theory that the development of the individual recapitulates the evolution of its kind, represents the mind of the race in its childhood. We find such evidence also in the early speculations of philosophy. But from the point of transition onwards, psychological history is the history of the problem of the conscious self. No doubt a gap of centuries lies between the vaguely felt distinction and the earliest records of explicit attempts to explain the nature of the universe and of man as a part of the universe. Such systematic attempts, however, were made by the Greek philosophers. Beginning with them, accordingly, we may divide our summary into four main periods : (1) the epoch of Greek speculation, in which the Mind-Body dualism arises in a general framework of philosophical theory ; (2) the period of mediæval thought, during which great emphasis is laid upon the mental powers as indicating the spiritual nature of man ; (3) the modern era, beginning with the distinction drawn by Descartes between the body and the mind ; (4) contemporary psychology, dating back to the introduction into science of the hypothesis of evolution.

The central problem of psychology emerged only gradually in Greek speculative thought, and phases in its development may be distinguished. Greek philosophy arose in an atmosphere of strongly religious and mystical tradition, and at first was mainly concerned with the study of external Nature in a search for principles by which the latter might be explained. The early philosophers were extroverts, *i.e.*, their interests were centred upon cosmic changes rather than upon themselves ; and they found the principles required in a physical element, or combination of elements, together with a life-principle not separated from these. All matter is alive, and all living things have souls. An advance was made, however, in the distinction of the forces of love and hatred (attraction and repulsion) from the original, imperishable elements, fire, air, earth and water ; an interpretation of physical change, though not clearly recognised, on the lines of psychical experience. Dualism begins vaguely to assert itself in cosmology, or the philosophical interpretation of physical Nature. It also asserts itself psychologically in a theory of perception. Perceptions are due to emanations from bodies which pass through the pores of sense to the soul, in which like is known by like. Thought is ascribed to all things without distinction, and depends upon the mixture of the elements. A still more interesting advance was made when the formative power of mind or reason was postulated to account for the origin of the world from a primitive agglomeration of infinitely small particles of every sort of substance. A principle which cannot be perceived by the senses is for the first time invoked to explain the evolution of the cosmos ; for mind is distinguished from material things by its characters of simplicity, freedom, omniscience and omnipotence. Just as hylozoism (the conception of the all-pervading life of matter) was a projection of unanalysed personal consciousness upon objects of the external world, so here spirit or reason, experienced in personal thinking, planning and willing, is a projection upon the universe. Thus cosmological dualism (world and soul) is the result of the beginning of reflective analysis of mental process. In psychology this indicates a clearer distinction between sensory and intellectual knowledge. The former, though not necessarily deceptive, is weak ; the latter acquaints us with the truth, and is due to a spiritual principle or soul. Mind, accordingly, is not only a principle which accounts for the formation of the world, and implies teleology or progress towards a goal ; but also in man it takes the form of an individual soul in a material body Immanent in the universe, it is also an immanent constitutive principle of the individual person. This doctrine marks a distinct advance in an entirely new direction ; but it was not consistently followed up, and gave place to a theory of atomism in which inherent necessity was substituted for mind or reason in explanation of the way in which cosmic processes came about by the aggregations of physical atoms. Yet psychological problems occupied attention even in this new phase of thought. A theory of knowledge was advanced in conformity with the atomistic postulate. Nothing save material atoms exists. Sense-perception, accordingly, is mechanically determined by images which emanate from objects and come into contact with the soul. But such perception is obscure and deceptive; for it presents as qualities what is, in fact, quantity. Thought also is a mechanical modification of the soul; but in thought we grasp the true natures of things as constituted by the invisible, quantified, material atoms. Impulse, conation (striving) and will are explained as the giving out again of the images received in perception. In this theory the distinction between soul and body is not rejected; but the soul, like all else, consists of atoms of " fire," perfectly smooth and round. It is the noblest part of man, warming his body while alive, and separated from it at death. Atomism reduces psychology to physics, but has significance in psychological history. By stressing the mechanical aspect of Nature, it made way for a vivid contrast between it and the subjective world of Mind; and by calling attention to the illusory nature of sensory knowledge it called for a critical examination of all knowledge by a subjective analysis. The antithesis between thought and perception came also to expression in other early schools of Greek thought. It was emphasised by the attempt to explain cosmic change on the basis of mathematical relations. Numerical concepts, unlike the changing objects of sense experience, are eternal, unchangeable, imperishable; and accordingly provide a higher kind of reality for thought than that reached in perception. Nature obeys the mathematical laws of abstract number; and to know Nature is to know the laws its phenomena express. Applied to psychology, this view makes the soul the numerical harmony of the body, just as the world-soul from which it derives is the harmony of the universe. Its parts, or faculties, are reason, understanding and desire. But this classification of powers is less important than the concept of the principle from which they derive as an abstract mathematical relation. This was a parallel of the still more abstract concept of Being, which was developed in another line of thought, and still further stressed the antithesis between sense and reason. A group of thinkers, beginning with the postulate that Being *is*, and not-Being can neither exist nor be conceived to exist, came to the conclusion that Being is one—unproduced, unchangeable and undivided. This fundamental doctrine of the absolute unity and immutability of Being acutely raised the problem of the distinction between reason and sense, and threw doubt upon the validity of sense-perception of the external world. Whereas intellect grasps reality as in fact the one and changeless, our senses reveal to us nothing but the many and change. The world of movement, becoming, appearance, is an illusion and a paradox. Such a position as this called for a criticism of the worth of knowledge, and again implicitly emphasised the necessity of undertaking such criticism from the psychological point of view

The doubts thus cast by all the schools alike upon the validity of sense-perception deepened in the scepticism of the Sophists. All truth, they taught, is relative to the observer; there is no objective truth. Admittedly our senses deceive us. Why should not reason deceive us also? Knowledge is only personal belief; contradictories are equally true if different people hold them to be true; everything is equally false. But even this movement of scepticism had significance for psychology. It drew attention to the personal element in knowledge. It reduced objective truth to personal opinion. And it immediately provoked an examination of the problem of the value of knowledge which played so great a part in the subsequent shaping of psychological science.

Up to this point Greek philosophy was predominantly objective. It dealt with problems of the physical world to the relative exclusion of man, his mind, its nature and origin. But it led to a view of the relativity of knowledge in the sense that knowledge is relative to the individual possessing it ; and this, at the hands of Socrates, Plato and Aristotle, was met by theories in which psychology definitely found its place and was expanded into coherent systems.

The outstanding contribution of Socrates (b. *circ.* 471 B.C.) to psychology was the substitution of the subjective for the objective method. The Sophists had followed the old method and given up the search for truth. Socrates, looking within consciousness rather than upon the external world, tried to determine the conditions of knowledge by an examination of the mental constitution of man himself. He thus established the validity of our concepts as products of logical induction and definition, and so provided a scientific basis for the principles of knowledge and conduct alike. His method was one of questioning, by which he helped his pupils to form for themselves concepts of the changeless natures of changing things. Starting with commonplace sensory experience, he led them by a process of induction to the admission of stable intellectual definitions. He thus countered the sceptical individualism of the Sophists with a doctrine of rational, universal and socially acceptable knowledge ; and showed that sense-perception and uncritical generalisation can be controlled by critical and logical thought. Logical concepts thus become both the test of truth and the guide of practical aims. Though moralist and logician rather than a psychologist, Socrates occupies a high place in psychological history because of his insistence upon the nature of the process by which true conceptual (abstract and universal) knowledge is reached, or may be reached, by all men.

The Socratic doctrine was developed by Plato (b. 427 B.C.) in a metaphysical direction, which had its bearing upon psychology, in his theory of Ideas. Plato regarded the Socratic concepts as being objectively existent things. Our knowledge of them is occasioned by, but not derived from, sense-perception. Ideas, accordingly, are not merely personal possessions differing from one individual to another, nor even mental contents shared in common by all men. They are realities in themselves, having an existence apart from the sensory world. For Plato, true knowledge is a grasp of changeless reality, not mere opinion born of sense-perception. Socrates had shown that the possession of concepts was the necessary and sufficient condition of stability in knowledge. But to what objects have these concepts reference ? Plato held that knowledge is something received, or given to the mind. Ideas, accordingly, are given ; concepts correspond to the realities from which they proceed. To deny this would be to deny the reality of Being, as well as all possibility of attaining to scientific knowledge. But the Ideas do not exist in the changing world of the senses ; and we are not in touch with any ideal world. How, then, do we come to know them ? Plato answers with a doctrine of reminiscence or memory. In a previous existence we actually contemplated the Ideas ; in this life, immersed in a world of flux and change, we recall them to mind.

We may thus distinguish the three worlds, *viz.*, of *concrete phenomena*, *concepts* and *Ideas*. Concepts are the mental representations of Ideas beyond the reach of sense ; sensory phenomena are their faint shadows or copies. The importance of this line of thought for psychology is evident. The contrast of sensory phenomena with Ideas, the making of subjective concepts into a real world of objective " universals," emphasising the old distinction of intelligence and sense, sets over against each other two objective worlds, the one the realm of intelligible reality, reason, order and goodness, the other a place of appearance, plurality, disorder and imperfection. But it stresses also subjectivity, and points to a necessary distinction between soul and body. The doctrine of reminiscence necessitates the pre-existence of the soul. This Plato defines as the principle of self-movement, explicitly rejecting the view that it is the harmony of the body. It is the living, moving element in man which perceives, knows and wills. But these processes are on different levels ; and the soul is accordingly divided into three parts, the rational, the courageous and the appetitive (desire), having their seats in the head, heart and abdomen respectively. The rational soul alone is immortal, possesses free-will, and is created by God. In a series of transmigrations into new bodies it gradually rids itself of its irrational parts through the conquest of desire by reason. Plato's psychology is built around his theory of Ideas, and moves upon the ideal plane. The nature of the soul is deduced from the theory rather than reached by an examination of mental activities. What is now understood as empirical or experimental psychology is, in Plato's view, part of physics, and therefore no true science ; for man, the physical object, belongs to the world of change and becoming and, like all appearance, is not an object of scientific knowledge. Nevertheless, though the rational soul is harboured in the body and thus bound to the world of appearance, by reminiscence it lives also in the ideal world. Plato advanced the two laws of association by similarity and contiguity—that like recalls like, and that, of things experienced together, one tends to recall the other to mind—in support of his theory of reminiscence.

We have seen that the problem of the constitution of the external world led to that of the validity of knowledge, thereby raising psychological issues. The doctrine of the stability of universal concepts had been opposed by a denial of the existence of anything except individuals ; and Plato's theory was advanced to bridge the gap, and relate the individuals perceived by the senses to the Ideas. He attempted to do this by deriving the former from the latter ; but he failed to show how the derivation comes about either in our knowledge or in the real world.

The problem was taken over by Aristotle (b. 384 B.C.), and its solution by him was made the foundation-stone of his whole philosophy. Like Plato, Aristotle held that there can be no true science of individual objects, for these are continually undergoing change. But he taught that stable intellectual knowledge nevertheless begins in sense-experience, in which only individual existent things are revealed. Instead of regarding experience as a mere occasion for the recall of Ideas, he held it to be the true source of conceptual knowledge. Instead of attempting to deduce individuals from Ideas he reached abstract concepts by induction from concrete instances. Individuals alone are real, universals are products of the mind discerning identity of nature amidst a plurality of things. Though these may change, the conceptual essences remain fixed and stable. Thus, although intellectual knowledge is essentially dependent upon sense-perception, it is also essentially superior to it. Aristotle's doctrine of knowledge implies radical differences between his psychology and that of his predecessors. In the first place, since scientific knowledge arises from sense-perception, his method is empirical. Natural events are explained on principles reached by induction. Though all involve change, the phenomena of Nature fall into different classes. Some things move (change) because moved by others; some change because they move themselves. The latter are alive; and life is accordingly defined as self-movement, of which the soul is the principle. For Aristotle, soul is not a synonym of mind or consciousness. It is the explanatory principle of every kind of vital process, including nutrition, sensation, movement and thought. Psychology, accordingly, is the empirical study of vital processes as manifested in plants, animals and man. But stress is laid upon sensation and thought; and, because the more perfect includes the less, and thought is a function of the human soul, the study of the principle of thought in man embraces all psychological problems. In the second place, though his method is that of objective observation, he does not neglect introspection. Indeed, Aristotle's theory of knowledge is built upon the introspective distinction of percept and concept (object of sense-perception, object of abstract thought); and a considerable part of his psychology is devoted to showing how we pass from the sensing of the former to a scientific knowledge of the latter. Nevertheless, his psychology is dominated by a metaphysical theory with regard to the constitution of individual things; and, indeed, it is on this theory that he accounts for the transition from perceiving to conceiving. Four principles are necessary to explain the constitution of all concrete beings in the physical order, and the changes which they undergo; matter, form, the efficient (or producing) and the final (or goal) cause. Of these, two are intrinsic principles of the thing in question, the matter and the form. Matter is that out of which the thing is made; marble, for instance, is the matter of the statue. But matter, before the statue is fashioned, is a definite natural substance; and it, in turn, is to be conceived as made out of a " first matter," an indeterminate though determinable principle which cannot exist or be known without form. Form, on the other hand, is the determining principle which actuates matter and constitutes it a definite kind of being, marble, oak, horse or man. It is that into which the thing is made. It is also the object of conceptual knowledge, the changeless essence abiding throughout all the changes the concrete individual undergoes. Applied to psychology, the soul is the form of the body; the matter of which body is formed is a mere potentiality of life which is actualised by soul. Accordingly soul and body, though distinct, constitute one substance only. Man is a unitary being. Furthermore, there is only one soul in man, accounting for all the processes of nutrition, appetite or desire, locomotion and reason. It is not divided, as Plato taught, into parts, but is distinguished into faculties which are the modes of its activity. The conception is a biological one, in which natural species are regarded as unchanging. Plants have nutritive and reproductive souls; animals have sentient souls with powers of feeling, imagination and locomotion; and man's soul adds to these the powers of reason, deliberation and will. In the biological scheme soul may be considered in an ascending scale, the higher developing from and ncluding the lower. In this conception, psychological data in the modern ense are not abruptly separated from physical ones ; but the observation of vital process is observation of behaviour as function of the soul. Aristotle incorporated an astonishing number of empirically established data into the framework of his theory. He divided mental powers into hose of knowing and desire, and connected the power of movement with he latter. He made a study of the special senses, and of the " internal enses " by means of which we perceive, imagine and remember. His xplanation of sensory process in general is that the forms of sensed bjects are received into knowledge without their matter. Sense is thus egarded on analogy with matter as potential to the reception of forms. To each external sense corresponds a " proper object," as colour to ision ; but besides these there are also " common objects," such as movement and shape, which we apprehend by several senses. The five xternal senses, however, are insufficient to explain perception, in which ifferent kinds of sensations come together. This function is ascribed to a entral sense ; from which also the latent images, without which reasoning s impossible, arise in memory. Aristotle states three laws of associative evival of experience—contiguity, resemblance and contrast (like recalls nlike) ; and he teaches that man alone has the power of active recollection nd constructive imagination. To account for conceptual knowledge he dvances a theory of abstraction. Like the senses, the intellect stands in elation to its objects as matter to form. It requires " information " in rder to understand. Its proper objects, however, are the universal essences of things ; and these " intelligible forms " are neither discoverable n the world of concrete beings nor exist apart as Ideas. The only things which exist are individuals. The intellect works, accordingly, upon the material supplied by the senses and illuminates the universal essence nshrined in the individual, thus mentally considering it apart from all ndividualising characters, such, for example, as time and space. Once endered intelligible in this way, the object impresses itself upon the assive intellect precisely as the sensible object impresses its form upon ense, and the intellect passes over to conceptual knowledge. Intellect is hus distinguished as active and passive, a power of rendering knowable hat was only potentially so, and a power of receiving intelligible forms. n this account of the processes of knowledge from the lowest to the ghest stage, the same general principles are invoked. All knowledge orinates in sensation ; but there is an activity which discovers the uniersal elements of thought in the concrete beings of sense. Is this activity faculty of the soul, or is it something transcendental to the individual an ? Aristotle's thought here is obscure and disputed. But in any case, ecause the intellectual activities transcend the conditions of matter, he olds that the acting intellect is both immaterial and immortal. On the ectic side (desire, striving, will) Aristotle is no less a pioneer in psyology than on the cognitive (knowing, remembering, etc.). His study movement led to the view that all perception is accompanied by easure or pain. These give rise to impulse and desire. Impulse, appetite and emotion lead to action. But besides these spontaneous motive there is also deliberate will, which may be described as intelligent desire Corresponding to the division of cognitive states, desire, will and choic are determined by percepts and images, by concepts and rational insight and in deliberate choice will is free. Aristotle's conception is that o moderate dualism in which soul and body are not separate entities, bu together constitute the individual. On this background he draws the line of a naturalistic and empirical psychology. The subjective point of vie is never lost, although the objective is greatly developed ; and psycholog takes its place among the biological disciplines as the final chapter o natural science.

There is little of psychological interest in Greek philosophy subsequen to Aristotle. Atomism was reasserted (Epicurus ; b. 341 B.C.) with th curious addition of a doctrine of freedom. To this determinism (denial o freedom) was opposed (Stoics), in an interesting anticipation of a vie of consciousness as consisting in passively received sensations, fro which all knowledge, feeling and will are derived. These sensation become representations when they rise with increasing clearness i consciousness. These two points mark a phase of development in th concept of the mental as contrasted with the physical, and also foreshado the modern doctrine of the subjective variation of clearness in ideas.

The last stage of Greek speculation has even less interest for psychology. Attempts were made to unite Jewish religious beliefs with th philosophy of Plato, Aristotle and the Stoics. The number theory an the theory of Ideas were revived ; but philosophy tended to degenerat into mysticism. The chief significance of these movements, so far a psychology is concerned, is that, infiltrating into Christian tradition, the influenced the thought of so great a psychologist as St. Augustine (A.D. 354).

PSYCHOLOGY IN EARLY CHRISTIANITY

With the spread of Christianity, the growing need of expressi its teaching systematically and providing an apologetic for it result in Patristic philosophy (*i.e.*, that of the Church Fathers), which arose subservience to religious dogma. In this there is little relevant to psychology before Augustine except the common distinction of soul and bod the doctrine of immortality, and an increasing precision in the concept personality. In Augustine, however, we find a psychologist of outstandi eminence, who left the impress of his thought upon all subsequent spec lation. Two pivotal ideas stand out in his philosophy : God and t human soul. The great stress laid by Christian teaching upon the value the individual raised problems concerned with the personality, natu origin and destiny of man. The theological doctrines of the Trinity a the dual nature of Christ accentuated those problems ; and in such a se ting Augustine's psychology was developed. Familiar with nearly all t philosophies of antiquity, he is in the main a platonist ; but he inc porated also into his system many results reached by other thinkers. H chief explicit contribution to the science is his vigorous assertion of t value of the introspective method, whereby he defines the subject-matt f psychology as the inner world of consciousness, distinct from that of hysical Nature. The soul is known in self-consciousness as a simple, imnaterial and spiritual being. This he proves from the fact of sensation, ising a neo-platonist argument : *viz.*, the soul is everywhere in the ody, since it receives impressions coming from all parts of the body. t is therefore immaterial ; for it is no one part of the soul which pereives, but the self as a whole. Further, he shows that it is immortal, on he ground that imperishable concepts are discovered within it ; and hat contains the imperishable must itself be immortal. The platonic haracter of these proofs is evident ; but the point made is that they are ased upon introspection, which reveals mental life as a continual acivity of the soul. This shows itself in three functions—intellect, will and elf-conscious memory—which are not distinct from the soul itself. The undamental principle is will, which moves intellect and inner sense to ction, and is both ethically and psychologically free. Man is therefore by ature a spiritual soul making use of a body. He acts upon the body, but not acted upon by it. The senses, accordingly, engender neither sensaon nor thought ; it is the soul which gives birth to both. Thus all ideas re innate, and are formed in the soul under the influence of divine illuination. Augustine classifies mental powers as faculties of sense and aculties of spirit. The former include appetite and sensory knowledge rising in connection with, but not dependently upon, the external and ternal senses. The latter are common sense, imagination and memory. aculties of spirit embrace will, understanding and intellectual memory. n Augustine's view the source (which is revealed by introspection) of ental activities, though united to the body, has its own substantiality, nd can be studied in its own right. In considering its origin, he hesitates etween creationism (the creation of the soul from nothing by God) and aducianism (the derivation of the soul of the child from those of the arents) ; but on theological grounds inclines to traducianism. A great ain for psychology is registered by Augustine. In separating the inner om the outer world he justified the study of the former as a distinct ranch of knowledge ; and in insisting upon the immediacy of self-onsciousness in reflective thought, he drew a sharp distinction between e self as subject and the objects of its knowledge, thus furthering the ualistic point of view. His influence in psychology is everywhere traceble throughout the Middle Ages, comes to more explicit development the beginning of the Modern period, and is manifest in many direcons of contemporary thought.

PSYCHOLOGY IN THE MIDDLE AGES

While Platonism colours Patristic speculation, Aristotelianism is the all-mark of Scholasticism (the philosophy of the mediæval Churchmen), ough both streams flow together and intermingle in mediæval thought. he principal representative of Aristotelian tradition is Thomas Aquinas . 1225, ? 1227), who stands out pre-eminently in the philosophical evelopment of the thirteenth century. More than ever before, psychogy becomes in his hands a comprehensive body of unified doctrine, sily separable from the rest of philosophy though intimately connected

with it. Aquinas is concerned with the nature of man in order to inf
from it his origin and destiny. He accordingly examines all human acti
ties to determine what human nature is and what it implies. He follo
closely the main lines of Aristotelian thought, but develops and alters t
traditional teaching in several important respects. In his view, all hum
activities are functions of faculties proper to man as a composite of mat
and form ; but the faculties are due to form, or soul, and not to matt
The existence of the soul is known in any one of its activities ; but
nature as a spiritual actuality is only grasped by diligent reflection up
the characters they display. Aquinas distinguishes the soul from its fac
ties and these from each other, however, because of irreducible diff
ences in vital operations which cannot be accounted for by any one sin
principle. Here he parts company with Augustine and clarifies the obscu
teaching of Aristotle. The faculties are the proximate grounds of t
vegetative, cognitive and appetitive functions. Aquinas, however, w
principally interested in knowledge and desire as expressions of the pur
mental life. He distinguishes knowledge into two orders, a lower, or se
sory, form and a higher, or intellectual, kind. In general, his explanati
of the processes of knowing is Aristotelian. The joint activity of the o
ject and the knowing subject engenders a mental image representative
the object. Sensation, perception and sensory appetite are regarded
psycho-physiological processes, stress being laid upon their physi
aspect. Here the interdependence of organic function and mental proc
is in striking contrast with the Augustinian view. Being organic, the sen
are passive powers, reacting to stimuli by the formation of sensatio
which are combined into images by an internal sense. Sensory process
however, acquaint us only with individuals. To the list of internal sen
Aquinas adds an estimative sense, the function of which is sensory jud
ment with respect to the useful or harmful character of concrete obje
Animals possess this sense ; but in man it is a kind of reason which de
with particulars. Intellectual processes also are accounted for on Aris
telian principles. Universal concepts are derived from sensory images
the process of abstraction and are subsequently universalised by a pur
mental activity. Passive and acting intellects are distinguished to meet
requirements of the general theory of knowledge ; but Aquinas cle
teaches that both " intellects " are intrinsic faculties of the soul its
Naturalism here replaces the vague mysticism which was taught by
Arab commentators of Aristotle and is traceable perhaps even to Arist
himself. A notable advance towards a purely scientific psychology is t
made. With regard to orectic processes, Aquinas again divides appetit
desire into the two classes of sensory and rational, which operate
different levels. Sensory desire inclines us towards objects perceived
imaged ; and its arousal gives rise to passions or emotions. These pass
were the object of careful study by the Scholastics in connection v
moral philosophy. Rational desire, or will, inclines us towards abst
Good, in respect of which its activity is absolutely determined. The
is free, accordingly, only with regard to contingent, or relative, go
One general law, however, regulates the life of desire, whether sens
or rational. Some kind of knowledge must call the appetitive powers
action. Knowledge is accordingly superior to will. In contrast with

Augustinians, and particularly Scotus, Aquinas is thus an intellectualist. The results of his analysis of mental process lead to the Thomistic conception of human nature. Since the soul is only the substantial form, the proper object of study is man himself and not the soul alone; but man acts as he does in virtue of being "besouled." Further, one soul only constitutes him a spiritual as well as a material being. The doctrine of plurality of forms, held by other Scholastics, was explicitly rejected by Aquinas. Nevertheless, though form of the body, the soul is a spiritual and substantial principle, independent of the organism in its highest activities of conception and thought. It is accordingly immortal; not, as Aristotle probably held, in the impersonal form of the acting intellect, but in the personal immortality of its whole being. It is created by God, and was created to enjoy eternal happiness in intellectual union with God. Though presented in a framework of theology, the psychology of Aquinas marks a distinct advance. It unites the biological view of Aristotle with the refined form of animism taught by Plato and Augustine. It thus avoids the dualism which makes two entities of body and soul, which destroys the unity of the individual, and raises insoluble problems with regard to the relation of mind and matter. At the same time, it leaves room among the natural sciences for psychology to deal with mental, as distinct from physical, phenomena, and justifies its existence as a special science with its own subject-matter, point of view, methods and principles.

In contrast with the psychology of Aquinas, several differences in that of Duns Scotus (b. 1274, ? 1266) have a bearing on more recent developments. Adopting Augustinian and Aristotelian doctrines, with personal modifications of great originality, Scotus agrees in the main with Aquinas; but he teaches that we have an intellectual knowledge of individual things. Besides abstract and universal knowledge, which is clear and distinct, we also know individuals in a confused manner simultaneously with our sense perception of them. This indicates a growth in clearness of mental contents arising from experience; and is a second anticipation of an important current doctrine in psychology. Again, because of its absolute freedom (knowledge of the Good being a condition, but not the cause, of will-acts) will, rather than intellect, is the pre-eminent faculty. This is in line with recent developments of Hormic psychology (impulse, striving), and even with certain postulates of Behaviourism (*see below*). Lastly, though man is the composite resultant of soul and body, Scotus teaches that a "bodily form," as principle of organic structure, also enters into his composition. Though he did not develop the view, this implies a step towards that of Descartes, in which soul and body are conceived as two separate entities.

The general results of Scholastic speculation that are most significant for psychology, are progress in the analysis of cognitive, volitional and emotional processes, as well as the establishing of relations between them; the making explicit of the essentially unitary nature of consciousness; and the development of a theory of personality centred upon the intuitive awareness of the self as a real psychical entity.

The movement reached its zenith in the thirteenth century. After long incubation it rose swiftly to maturity; but hardly less swiftly decay set in. The springs of inspiration dried at their source. Growth and development were arrested ; and mere dialectic (argument and hair-splitting) took t place of empirical analysis and the closely reasoned speculation bu upon it. So far as psychology is concerned, there is an almost comple blank between the thirteenth and sixteenth centuries.

THE BEGINNINGS OF MODERN PSYCHOLOGY

With the rise of the scientific movement, however, it was not lo before psychological problems appeared in a fresh setting. At first, as Greek philosophy, interest was primarily centred upon external Natur but even Bacon looked forward to the time when empirical metho should be applied, not only to physical and physiological events, but a to the interplay of ideas and the activities of the will.

The two great forerunners of modern psychology are Descartes 1596) and Locke (b. 1632), from each of whom derive influences whi have fundamentally affected psychological thought up to the prese day.

Descartes' philosophy began in a universal, methodic doubt which p pared the way for the discovery of incontrovertible truth ; and Descar found this truth, from which he proposed to deduce all others, the fact of personal, self-conscious thought :—" I think ; therefore am." One may doubt all else, even one's own bodily actions ; one cann doubt such self-evident intuition. Upon the clearness and distinctness this truth he based his criterion of valid knowledge. Whatever is as cl and distinct as self-consciousness is true. But for the supposition t some power superior to our own might deceive us in all thin Descartes might at once have applied this criterion to the clear and d tinct idea of extension as revealing the nature of matter, and so ha raised the antithesis of body and mind. Instead, he turned to the idea God ; from which he " proved " the existence of a Being whose goo ness and wisdom guarantee the veracity of our faculty of knowledge. Cl and distinct ideas (innate in the sense that the mind is predisposed accept them), and whatever is deduced from these, are accordingly va Among such innate ideas is that of the nature of matter as consisting extension ; and this is sharply distinguished from sensory perceptio in which bodies appear to be coloured, sonorous, odorous, and the li These qualities are obscure and confused subjective appearances, and objective properties of things. The essence of body, accordingly, is to extended ; and the essence of mind is thought. Here is a metaphys dualism in which the main problem that exercised subsequent speculat arises. What is the relation between body and mind ? The antithesi further emphasised by Descartes' teaching that animals are autom without feelings or power of self-movement, which obey the physical mechanical laws that regulate inanimate Nature. Only in man's cas thinking mind is infused into the automaton by God. Thus essenti opposed to body, the human mind must somewhere come into cont with it to explain the reception of sensations and the production of mo ments. Descartes locates this contact in the pineal gland at the base the brain. Here the mind receives feelings from the nerves, and bri about motions in the body by way of the " animal spirits " flowing in nerve channels. Sensorial life thus has a physiological basis, whereas true thought is wholly mental. The automaton doctrine disposes of the soul as the principle of life in man, and substitutes a thinking mind joined to a mechanically regulated body. The main point brought out in all the detail of Descartes' psychology is the refining of the concept of mind to include conscious events, and the reduction of sensory and motor processes to physical ones. There is interaction between body and mind, but complete disparity of nature. This doctrine bore fruit later, when interest in the body-mind problem gave place to empirical psychology, in a clearer definition of purely mental phenomena.

The line of thought deriving from Descartes was largely occupied with the psycho-physical problem set by him. The Occasionalists, distinguishing between occasion and cause, held that the body does not cause sensations nor the mind movements, but that physical stimuli and conscious volitions are mere occasions of sensations and movements which, in fact, are caused by God. Leibniz advanced a theory of divinely arranged, or pre-established, harmony. Soul and body do not directly influence one another; but their actions run in parallel lines. Spinoza, more radical, made of mind and matter two aspects of the one underlying reality, God. Instead of Descartes' interaction, these philosophers asserted psycho-physical parallelism in solution of the difficulty.

While on the Continent rationalism continued its development, in England the foundations of empirical psychology were being laid. Already Hobbes had attacked the concept of a substance-mind, and taught that mental process is a function of the body, and reason the product of sensation. Here lay the germ of modern materialism and associationism (the doctrine that all mental processes are accounted for as associations of ideas). But we must look to Locke for the full use of the empirical method in psychology. Instead of the deduction of conclusions from the supposed nature of mind, he uses the method of induction to reach a scientific knowledge of the principles of mental life. He thus rejects metaphysical and mystical accounts of the origin of knowledge (innate ideas, pre-established harmony, divine inspiration) for a theory based upon observation. Children, he argues, uneducated people and savages show evidence that knowledge originates in experience. At the outset the mind is a blank tablet. How, then, do ideas become inscribed upon it? Locke teaches that all ideas derive from experience by sensation and reflection. By sensation we perceive the external world as possessing qualities and quantity; but the (secondary) qualities, colour, odour, etc., are subjective only. By reflection we are acquainted with the inner activities of understanding and will. Ideas are simple or complex, the former simply given to the mind, the latter actively formed in it by repetition, comparison and combination of elementary ideas. Mental powers, however (*e.g.*, sensation, memory, imagination, understanding, will), are not separate entities, but only ways n which the mind acts. Locke's distinction between sensation and reflection shows that mental process is not merely a mechanical interplay of ideas. Mind has the power of reflecting upon the course of its ideas; and n reflection higher ideas (*e.g.*, power, cause, unity, relation) are formed. Thus universal ideas are explained on an empirical basis; a protest gainst the doctrine of innate ideas. Locke deals more cursorily with the

active powers of the mind. Pleasure and pain are kinds of sensation ; v
is a mental movement due to " uneasiness " ; and both arise in course
the interplay of ideas. His empirical analysis is clearly a forerunner
later analyses of consciousness into contents and states ; but Locke nev
disputed the existence of a substantial, active mind. He accepted this
a fundamental datum. It was the existence of the external world t
needed explanation ; and our certainty of this, he taught, depends up
the impressiveness, or " liveliness," which characterises certain subj
tive sensations.

The last statement shows how the next analytic step could be tal
by Berkeley (b. 1685). Already secondary qualities had been den
of matter and made subjective. For Berkeley the primary qualities (
tension, impenetrability, etc.) also became mental states no less than
secondary. The external world, accordingly, has no reality except in mi
to be is to be perceived. All experience is subjective. This Berkeley argu
in his *Theory of Vision*, in which he showed how our idea of tridimensio
space results from the association of sensations of sight and touch. Ide
however, presuppose some cause upon which they and their sequen
depend ; and, having shown that no material reality exists, Berke
asserts that their cause must be spiritual. Moreover, since the sens
ideas do not depend upon our personal wills, it follows that it is not
but the eternal, uncreated spirit that produces them. Matter does
exist ; spirits alone exist : God and human minds. And the mind i
simple, active being, revealed through experience. Sensory percepti
are ideas in the mind of God, who causes them to appear to us. The p
ceiving mind is reason, as contrasted with the acting mind, which is w

Berkeley's idealism forms a stepping-stone between Locke and Hu
(b. 1711), whose psychological system had an immense influence up
the development of the science. A radical empiricist, Hume set out to m
an exact analysis of mental powers and capacities. He begins by reduc
mind to the sum of its contents. He rejects Locke's distinction betw
sensation and reflection, and substitutes a law of association for
dynamic activity of the mind. The fundamental mental states are
lively impressions which originate both in outer and inner experien
and their fainter copies, or ideas. We thus have as original element
mind visual, auditory, tactile, etc., impressions and ideas, as wel
pleasures, pains and efforts ; and these are the sole data of knowle
Connected, compounded and succeeding one another in virtue of asso
tion by contiguity, similarity and causal relationship, they constitute c
sciousness ; which is accordingly conceived as an agglomeration of s
sations regulated by the principles of association. Where Hartley
1705) used associated nervous processes to explain the occurre
and order of mental events, Hume postulates only mental elements
mental laws, thus avoiding any appeal either to body or to mind in
planation of consciousness. Impressions, ideas and laws of associa
take the place of brain processes, as well as of any really active princ
of thought. Even the self is reduced to a mere bundle of associated id
While Locke reasoned away secondary physical qualities and their
known substratum, while Berkeley extended the reasoning to prim
qualities and physical substance, Hume used the same line of attack u

the mind itself, and nothing substantial remained. Hume's empirical analysis of causality, which reduces even will to sensations, is equally radical. The causal relation is one in which two ideas are constantly experienced in a sequence; and repetition of such experience in the past sets up the habit of expecting a similar relation in the future. But there is no real efficiency in the "cause." For, if we analyse the notion of power it contains, we find no more than the sensations of effort we ourselves experience when we move external bodies, or those of the impact of bodies upon us. Here there are only several sensations in constant sequence (feeling of effort and movement of limb; sensations of moving body and impact). No real power is involved in either case. We read our sensation of effort into sequences of external events, and come to an illusory belief in real power, or energy, resident in the "cause." We experience effort and believe in our own causality in willing. But this is illusory also; for, though perceived movements follow upon will-acts, this is in fact apprehended only as a sequence of strongest motive as inner event and change of place as outer event. Feelings of pleasure and pain, corresponding to impressions, give rise to emotions, which are thus also reduced to sensations and become associated with ideas. The system is one of radical sensationalism, in which all mental events are hypostatised; and psychology is presented as a naturalistic and positive science, the task of which is to investigate the structure of consciousness. It is no longer the science of soul or of mind, but of mental phenomena. Hume's influence in psychology can hardly be over-stated. He was the founder, with Hartley, of the Associationist and Structuralist schools which have lasted almost to the present day. Transferred to France, his doctrines were modified into a still more complete sensationalism by Condillac (b. 1715), who omitted the principle of habit as accounting for mental synthesis. In Britain and abroad, these movements provoked reactions in the Scotch "Common Sense" philosophy and French Eclecticism. Hume's psychological doctrines were developed in the two contrary directions of spiritualism and materialism. Everything being reduced to sensation, it was easy to construct the world out of ideas, as Berkeley had done; and scarcely less easy to identify sensations with states of the brain, as did Hartley, Priestley and the French Encyclopædists. Finally, it was Hume's phenomenalism and "scepticism" which awoke Kant from his dogmatic slumber to labour at his Critical Philosophy.

Three further influences have contributed to the shaping of contemporary psychology. Already in the movements of Cartesian rationalism and Locke's empiricism, we find many of its elements; but the speculations of Leibniz (b. 1646), the philosophy of Kant (b. 1724) and the formulation of the theory of evolution by Darwin (b. 1809) supplied other exceedingly important ones.

Leibniz's conception of the world is wholly psychological. Unlike Descartes, who set himself to doubt all previous principles and conclusions of philosophy, Leibniz wished to establish a system n which Greek, Mediæval and Contemporary thought would be econciled. To this end he advanced a theory of reality of which his doctrine of monads, principle of pre-established harmony, and law

of continuity, are the cardinal points. Mind and matter, divorced
Descartes, were to be reconciled in a panpsychism (universe in which
that exists is held to be spiritual). Leibniz begins with the concept
mental substances as independent activities, essentially individual, y
together constituting a world. These active forces he calls " monads
He conceives them, on analogy with material atoms, as simple, indiv
sible and indestructible ; but he also endows them all, in varying degre
with the power of mental representation. The human soul is such
monad, conscious of what it represents. Others represent the univer
confusedly or even unconsciously, and so reflect every other monad
existence. The world consists of these immaterial monads in an ascendi
scale of perfection, their place being determined by the degree of clea
ness with which each actively represents the rest. Thus the lowest (ino
ganic) monads manifest unconscious representation in attraction a
repulsion only. Plants are " sleeping monads " with unconscious idea
or formative vital forces. Animal soul-monads represent obscurely
sensation and memory ; while the human soul is capable of forming cle
and distinct, as well as adequate concepts. There is thus an absolu
psychical continuity between the lowest monad and the human sou
Though the conception is vitalistic, it is not that of Aristotle ; for, inste
of interpreting mind in terms of life, Leibniz interprets life in ment
terms. Bodies are aggregates of simple monads apprehended in obscu
sensory perception as spatially and temporally ordered, but in cle
analytic thought as aggregates of active spiritual entities. No mona
however, can act upon another, or receive influence from it. Their a
tivity is wholly immanent, or within themselves. A problem according
arises with regard to the correspondence of the succession of ideas in t
mind with the movements of the monads of the body. Leibniz solves th
problem by postulating a pre-established harmony between them. So
and body agree like two clocks, originally set going by God and absolute
synchronised. Remote as his doctrine may appear from contempora
psychology, it nevertheless has had considerable influence upon it. T
assertion of unconscious mental activity is accepted to-day. The conce
of growth in clearness of ideas from unconsciousness to full apperceptio
or clearness (as in Scotus and the Stoics), has born fruit in many directio
And the doctrine of the essential activity of self-consciousness as dynam
will (Augustine), which determines the course and clarification of repr
sentations in consciousness, has left its impress upon the science.

The philosophy of Leibniz was a consistent and closely reasoned sy
tem. At the hands of his follower Wolff (b. 1679) it became little mo
than a series of dogmatic assertions. The meeting point of Dogmatis
and the scepticism of Hume in the mind of Kant gave rise to the Critic
Philosophy. Kant opposed all speculation which goes beyond empiric
experience without first having justified its procedure by a prelimina
critical examination of the extent and limitations of knowledge. Impress
by Hume's analysis of causality, which regarded belief in the causal r
lation as being due to a subjective element of habit or custom, and co
cerned to distinguish the universal element in knowledge from the pa
ticular elements of experience, he was led to the hypothesis that, inste
of the mind conforming to objects in knowing them, objects conform

the mind. The manifold items of experience become unified and stamped with the impress or form of mentality. Since nothing necessary and universal can come from experience, space and time (the universality and necessity of which are shown in mathematics) must be subjective forms, prior to all experience, which are impressed upon sensations. They are the pre-requisite conditions of external and internal sensation. Things-in-themselves are neither spatial nor temporal ; co-existence and succession are phenomenal—appearances only—and accordingly are only subjective. Analysis of judgement shows further that there are subjective categories, forms of thought not derived from experience, under which phenomenal knowledge becomes organised. Since these, like the sensory forms, are logical and subjective conditions of knowledge, reality as it s in itself remains unknown. By speculative knowledge we can reach neither to the real self, the world nor God. Nevertheless, Kant's doctrine of the unity of apperception and of the categories has profound significance for psychology. The organisation of disparate items of experience into mental objects with spatial and temporal characters, their interpretation by inclusion in a category, points to more than was dmitted in Hume's sensationalism. Though we cannot know its nature, the doctrine reintroduces the notion of a self which actively organises experience. Moreover, even if we cannot grasp things-in-themselves, we do know our own organised experiences ; and it is thus possible o formulate psychological laws on the basis of experience, even in the bsence of knowledge of the soul. Kant's treatment of willing and feeling llows him to bring back into philosophy what his analysis of pure reason had made him reject. Passing from consideration of thought to that of ction, he finds a "categorical imperative" in the consideration of duty. This presupposes the freedom of the will, the existence of God and the mmortality of the soul. The ultimate value does not lie in the region of knowledge, but in that of will and feeling, where teleology, or the seeking of ends and goals, and æsthetic appreciation are experienced. Feeling, willing and knowing are three separable faculties. Though Kant declared hat an exact science of psychology was impossible, his general position ndicates how such a science might be built up. It must no longer be conerned with souls, but must study experience ; and, to be successful, must mploy mathematical method. In rejecting metaphysics and "subjectifying" physical science by introducing mental elements into its construction, he revealed a point of view for the study of mental phenomena which greatly influenced subsequent speculative thought. His place in psychological history is indicated by his comparison of himself with Copernicus as a revolutionary in science, making objects conform to mind rather than making the mind merely reflect objects. The implications of this reversal of theory have remained a permanent gain.

While in Britain and France empiricism developed, in Germany psychology never wholly lost its metaphysical background. Herbart .1776) combined elements of the philosophies of Kant and Leibniz, ut laid greater stress upon introspection. He rejected the doctrine of nitary faculties ; and postulated a simple, active soul as the subject of mental life, teaching that ideas are due to its reactions upon other beings " Reals ") with which it co-exists. He attempted to express all psychical

activities in mathematical formulæ and to reduce mind to a kind of me
mechanics. Conscious states are thus regarded as an equilibrium of
posing forces. Ideas are conceived as complexes of sensations ; but
stead of passive links between them, as in associationism, he postula
active mental forces which are conceived as summating algebraica
Ideas struggle together or ally themselves in consciousness. The conc
tion suggested an unconscious region of mind into which ideas, that
too feeble for successful competition, sink, to rise again when their
posing ideas weaken, or when their own force increases by alliance
others. The dynamic alliance of ideas, to which fresh material is assi
lated in learning, is called by Herbart an "apperceptive mass." It is
ceived as an aggregate of active past experience to which new ideas
themselves. Apperception is thus the active combination of ideas in
growing unity ; the dynamic background of experience makes the assin
tion of fresh material possible. This conception was, and still is, of g
fruitfulness in educational theory and practice. Herbart's aim wa
make psychology an exact empirical science, with practical applicati
Though his dynamic of ideas did not prove successful, he certainly
vanced the study in both these respects.

EVOLUTION AND PSYCHOLOGY

The positivistic trend in England was given fresh impetus by the
statement of the hypothesis of evolution and the vast amount of evid
collected in its favour. Though formulated in several quarters be
his time, it was the influence of Darwin in its support, more than
other, that went to shape contemporary psychology. Both Lamarck
Darwin held that acquired characteristics (or at least some) are cum
tive, and inherited from previous generations, and that these chara
istics are acquired not only by the action of the environment upon
organism, but also, in part, by the efforts of the creature to adapt itse
its environment. This implies a psychological factor in evolution ;
though the inheritance of acquired characteristics is not now gene
accepted, the view proved to be an incentive to research and a work
principle of interpretation. Darwin's psychological interests were e
ordinarily broad and profound. He applied the principle of natural s
tion to problems of instinctive behaviour, emotional expression in
and animals, protecting and attracting traits, and the like ; and in
Descent of Man he extended the same principle to higher mental
cesses also, and showed the similarity between human reasoning and
cesses of the animal mind. The influence of the evolutionary hypot
upon psychology was enormous. Like the saturated solution of a
into which a crystal is dropped, current psychologies began to cryst
round it. The mental gulf between man and the rest of the animal
dom was bridged. Genetic views of the mind came speedily to re
static ones ; and many acute psychological observations, from Aris
onwards, were found to fit readily into the new naturalistic scheme.
stage was fully set for the development of contemporary psychology.
first thoroughgoing application of the new principle was made by Spe
(b.1820) within the framework of associationism. On analogy

the derivation of complex organic structures from simpler forms he derived all more complex mental states from primitive sensation, or feeling, elements which accompany elementary nervous process. Intelligence was similarly derived, through instinct, from primitive reflex action. Mental products are, accordingly, capable of analysis into simple elementary forms ; and by association these are bound into wholes, not merely in the developing mental life of the individual, but racially also. Associations formed in early social experience, animal or human, are stamped in and transmitted by heredity. There is thus a reconciliation of innate ideas and experience ; the universal and necessary elements of thought coming, not from individual experience, but from that of the race. They are the result of past history recorded in hereditary neural arrangements of the brain. Feelings, emotions and will are reduced to aspects of complex sensory processes, the complexity of which is conceived on analogy with chemical compounds, rather than as the result of summation or mere addition. Here is no hint of any synthetic or creative activity of a conscious self in respect of its own mental contents ; the psychology is a wholly structural one. Indeed self, as mind-substance, is for Spencer only an unknowable something postulated to explain persistence and unity, in spite of all changes, in the aggregate of states of consciousness. Like all associationisms and structuralisms Spencer's psychology is now outgrown. It was none the less a contribution of worth, focussing attention upon the naturalistic evolution of mind as a subject of special study. It indicated the place of psychology among the other biological sciences ; and, by insistence upon the racial derivation of ndividual mental characteristics, related the science closely to sociology.

A second consequence of the acceptance of the Darwinian hypothesis was the application of the concepts of variation, selection and adaptation o the study of individual differences. Though experimental work had hown that people differ in respect of sensory acuity, quickness of eaction-time, and the like, it was Galton (b. 1822) who first investigated the problem of individual differences on a large scale in his studies f hereditary genius, mental images, mental number-forms and similar matters. Even more important was his contribution of a statistical method, which was to prove of enormous service in psychological investigation. n order to find the relation between mental qualities, which cannot irectly be measured, we require some device by which we can ascertain ow far they tend to go together. Such a device Galton provided in the coefficient of correlation," which has since so been developed and perfected as to be of inestimable value in psychological research. The raising f the problem of individual differences, and the creation of this instrument of research, entitle him to a foremost place as a pioneer of contemporary psychology.

A third consequence of the introduction of the hypothesis of evolution as the extension of psychology to the comparative study of animals, primitive peoples, children and abnormal persons, with a view to discovering genetic relations between them and normal adults in respect of mental rocess. Whereas previous interests had chiefly been directed upon the ormal adult mind, either deducing its characters from the nature of the oul, or inducing its principles from empirical observation, interest now was largely centred upon evolutionary connections. Behaviour in all forms, interpreted on analogy with the personal conscious behaviour the student, was closely observed by naturalists; and observation experimental conditions later on took the place of uncontrolled fi work. A vast and growing literature upon animal, child, primitive a pathological psychology began to accumulate. Experiments upon cr tures, ranging from unicellular organisms to anthropoids and you children, were multiplied; and the original impetus, far from spend itself, has steadily increased up to the present, every school of psychol drawing inspiration from the comparative observation of behaviour. T chief dangers of this line of attack have been an undue tendency to int pret the behaviour of animals and children as if they were human adu and the "behaviouristic" tendency to dispense with consciousness a gether in interpreting the actions not only of lowly organisms but even man himself.

EXPERIMENTAL PSYCHOLOGY

Already experimental psychology had begun, in a small w in the attacks made in physical and physiological laboratories u problems connected with sensation. Both psychophysics (the correlat of mental with physical changes, when physiological conditions are k constant) and psychophysiology (the correlation of mental events w physiological changes) had made headway. The growth of the exp mental spirit in psychology is indicated, as we have seen, as far back Herbart. It is illustrated by such work as that of the physiologists We and Fechner, who established the psychophysical law of sensation (*v* sensory intensity increases in arithmetical progression while the stimu is increased geometrically). It was advanced by physicists like Helmho who investigated vision and hearing as well as the temporal difference reaction-times. It came at length to a head in the establishment by Wu of the first exclusively psychological laboratory at Leipzig. Here not o sensory processes, but higher mental processes also—memory, imagi tion, attention, association, feeling, emotion, thought and will—w proposed for investigation. Within a comparatively short time psycho gical laboratories multiplied throughout Europe and America: and at present day there is hardly a centre of psychological teaching wh experimental work, forming the nucleus of training and theoretical tea ing, is not carried out. Besides observation and introspection, the ordin methods of physical science are employed; and within the past few cades statistical treatment of the data of research has increasingly b followed up. These methods, becoming progressively more refined adapted to the subject-matter, have proved not only fruitful in their ap cation to special problems, but illuminating in general psycholog theory also.

The multiplication of centres of research, and the continual splitting of larger problems into their parts for detailed solution, have led to creasing specialisation in psychology and a shift of interest even gre than that caused by the introduction of the empirical standpoint. The problems concerned with soul, mind or consciousness, its relation body, its origin and destiny, have largely been thrust out of view by preoccupation with more immediate issues. They have been left to the philosophers, while experimental psychologists have busied themselves more and more with the investigation of mental processes as such in all their detail. This does not mean that the more fundamental problems are no longer urgent. It means a distribution of labour, in which the experimentalists are content with the spadework that yields immediate practical returns. For psychology to-day is in the position of physical science when this made its greatest advances, and applied its discoveries in every direction to social and material well-being. There also more fundamental problems lay in the background, which to-day the mathematical physicists are attempting to solve. It is not unduly optimistic to hope that the immense amount of material being gathered together in experimental psychology will lead to an empirically established and acceptable view of the nature of the conscious principle.

SOCIAL AND COMPARATIVE PSYCHOLOGY

Another line along which psychologists have been working, is the investigation of man in his social aspects. This also may be traced to the nfluence of evolutionism upon the science. It has led to the formulation of doctrines of social and dynamic psychology which supplement the data derived from the experimental investigation of mental process, and ink up comparative with normal, abnormal and pathological psychology. No longer considered as isolated individuals in a merely physical environment, the reactions of organisms, and particularly of man, to social timuli were investigated. What are the springs of action which instigate behaviour in response to such stimuli ? The hormic psychologies provide n answer. The original drives to action are the inborn psycho-physical, r body-mind, dispositions, differing in different organisms, to behave in ypical ways upon external stimulation whether physical or social. Pro- usely illustrated in the behaviour of lower animals, and especially of nsects, they are the primary motives of all behaviour, in the service of hich all the cognitive powers have their existence and meaning. It has een said that intelligence is a tool at the service of instinct. How far own in the biological scale animals are to be credited with consciousness nalogous to ours may be disputable ; but there is evidence of adaptation y insight, or by trial and error, which makes learning possible at a very w stage indeed. Such cognitive powers as animals may possess are accordingly regarded as serving the original hormic forces. The action of hese forces, however, may become modified by consciousness in various ays. Fresh kinds of stimuli may become substituted for those originally dapted to release them. They may become specialised to a single indi- dual belonging to the class of stimuli apt to activate them, and so be ore readily called into exercise by that individual than by others. In eatures capable of mental abstraction and conception, moreover, the ormic drives may come into play in response to stimulation by abstract nd conceptual ideals. On the other hand, modifications of original forms behaviour, or behaviour-patterns, also come about dependently upon ocesses of trial and error and of insight. This is especially noticeable in human social conduct, in which the goals of instinct are not as a ru directly attained, but are secured through means that are often of exceedingly circuitous kind. Thus all the social machinery of law, i dustry, commerce, and the like are human inventions used to secure t instinctive ends prescribed by Nature. Hormic psychology presents very complete dynamic view of human behaviour, into which the deta of comparative and experimental psychology naturally fit. It thus flects the best features of pre-scientific psychology, and provides a bro foundation for the investigation of the nature of the principle of conscio life. In its recognition of dispositions, drives or tendencies, it emphasis the part played by the unconscious in the determination of consciousnes and, by extending mentality beyond the region of awareness, it points t mental vitalism comparable with that of Aristotle.

Having indicated the main directions in which the currents of co temporary psychology are flowing, it will be convenient to summar the present position of the science under several heads, roughly corre ponding to the division of mental process into cognitive, conative a affective. Though there may be some unavoidable overlap, this v enable us briefly to review and contrast the chief schools of psych logical thought in existence at the present day.

From what has been said with regard to hormic psychology, it will clear that the investigation of cognitive processes has its bearing upon explanation of behaviour ; for modification of inborn, or connate, haviour-patterns depends upon forms of cognition. From the lo organism which slightly alters its native reaction to a stimulus when c fronted with difficulty in attaining its end or maintaining its " psyc equilibrium," to the human being who plans a long and complica series of actions leading to some remotely conceived goal and strives attain it, the strivings are determined by cognition, but at very differ levels. No one of us, however, has direct insight into the mind of creature other than himself ; and we must accordingly interpret behavi at all levels, on analogy with our own, and refer it to mental proces which we immediately apprehend in introspection. Analysis of hum consciousness must yield all our principles of explanation. Such anal has led to the formulation of four principal theories of cognitive pro which are advanced to-day. All except one are protests against the asso tionisms and structuralisms in which mind was reduced to the sum tota its phenomenal elements or states. The remaining one is an extensio associationism to physiology ; and it contrives to do away with con ousness altogether. Since we have already considered associationism dealing with Hume and Spencer, no recapitulation is necessary here. need only recall the main point of the theory ; *viz.*, that all processe consciousness whatsoever are reducible to sensations regulated by asso tive laws. Apart from the distortion of many mental phenomena by f ing them into the too rigid framework of the theory, the omission of functional and dynamic aspect of mind was fatal, as is shown by all c temporary presentations of psychology, including Behaviourism. Dy mic activity is smuggled in by way of neural process, even if it is not mitted right of hospitality in consciousness. Associationism has b ousted by contemporary systems, because it was inadequate to exp

ital factors of personal experience. It had no place for emotional activity,
urposive striving, or creative thinking.

BEHAVIOURISM

In a sense, however, it has taken on a new lease of life in the more ex-
eme form of Behaviourism ; but at the price of sacrificing consciousness
ltogether. Behaviourism is not only a psychology without a soul ; it is
sychology without either mind or consciousness. It proposes that the
onsideration of psychologists should be limited to external and observ-
ble behaviour ; and then proceeds to explain behaviour, in a strictly
eterministic manner, in the light of the principle of contiguous associa-
on. In this theory, all forms of behaviour in animals, all kinds of human
onduct, no matter how socially desirable or morally elevated, are con-
eived as built upon the foundation of a few native reflexes inherited by
l the members of the species. Like any other animal, man starts life with
limited equipment of unlearned reaction-patterns to external stimuli ;
nd upon these are grafted an immense number of other behaviour-
atterns, which make up his learned equipment. To explain the activa-
on of reaction-patterns by stimuli other than those which originally
one called them into activity, the behaviourist uses the principle of
e conditioned reflex. Experiments have shown that a stimulus that
incapable of provoking a given reaction will, after presentation to-
ether with a connate stimulus to that reaction, evoke it. Thus Pavlov
duced salivation in dogs as a reaction to the ringing of a bell, after the
ell had been rung a number of times in connection with the presenta-
on of food. Watson, again, showed that fear-reactions, originally pro-
oked in very young children only by startling stimuli, such as loud noise
loss of support, could be associated with the sight of objects with
gard to which the child had previously exhibited no signs of fear. A dog,
which the infant had before only shown interest, afterwards provoked
ar-behaviour if it had been seen at the same time that the child had
een frightened by a violent noise. Similarly, rage and love reactions,
aturally provoked by a limited range of definite stimuli, could be " con-
tioned " to others. Moreover, just as the connate connections admitted
a fairly wide range of stimulus (*e.g.*, *any* loud noise) in provoking ap-
ropriate responses, so the conditioned reactions, it was found, spread
so to stimuli that only resembled the one to which they had actually
een conditioned (*e.g.*, the child would not only fear a dog, but anything
ke a dog, as, for instance, a teddy bear, or even a bit of fur or cloth). This
oks like association by similarity, but in fact it can be reduced to con-
guous association. On the basis of associative attachment, or " condi-
oning," and substitution of stimuli, together with alteration in the
aracter of the response, behaviouristic psychology was erected, but on
physiological rather than a psychological foundation. It is a system
rongly reminiscent of that of Hartley. The original endowment of
an is a group of physiological reaction-mechanisms of a relatively simple
nd. All complex behaviour is explained by environmental conditioning,
hich results in the formation (and re-formation) of habits as physiolo-
cal as the inherited mechanisms themselves. The concept of instinct,

accordingly, is not needed to explain behaviour ; neither is the conce
of consciousness nor thought. For thought also is only a conditioned rea
tion to external stimuli on a par with any other. It consists in feeb
movements of the organs of articulation (inner or sub-vocal speec
which have become substituted for the gross movements of limbs a
body that were originally evoked by the same stimuli. The evidence up
which behaviourism is based is of a conative, or emotional, order rath
than cognitive ; and the theory ends in excluding thought as an intere
ing or useful topic for psychological investigation, and denying to co
sciousness any effective part in the determination of behaviour. It m
therefore seem out of place to consider behaviourism in this section, e
cept as an instance of refusing to allow mental processes any right
citizenship in psychology. Behaviourism is not at present maintain
however, in its exclusive and rigid form, as outlined above. Though
considerable group of psychologists would still call themselves behaviou
ists, and make use of the conditioned reflex as the chief explanatory pri
ciple in psychology, there are few who altogether dispense with consciou
ness, or employ the principle of stimulus and physiological respon
alone to explain behaviour. Both consciousness and thought have be
reintroduced into more moderate Behaviourism. Though genetic and ev
dynamic as a theory, its single principle was not enough to embrace
the facts. It could not explain how new ideas, or new types of behavio
could arise, except as mere rearrangements of old ones. Yet thought,
some of its operations, is creative ; and some behaviour gives evidence
true originality. Behaviourism could not continue to maintain that thoug
is sub-vocal speech, for definite experimental evidence disproves t
statement. While the general bias of Behaviourism, accordingly, is towar
a physiological explanation of mental events, its original formulation h
been greatly modified. There were, however, aspects of permanent val
even in the original statement of the doctrine. It was a protest against t
merely structural view of consciousness to which pure introspection h
led. It emphasised the importance of an objective examination of b
haviour as functional. It introduced the principle of conditioning a
transfer into general psychology in connection with behaviour, and n
merely as a mode of association of inert ideas ; and thus indirectly pav
the way for a return to the dynamic conception of consciousness. Final
though failing to account for purpose and volition as human experienc
its aim of determining behaviour on morally and socially desirable lin
by the practical use of conditioned reflexes—its very name *Behaviouri*
—suggested the lines upon which all along psychology had been develo
ing ; *i.e.*, as the science of the principles of behaviour, by the applicati
of which conduct might be directed and guided.

FORMALISM OR "GESTALT"

A second type of contemporary psychology, definitely in revolt agai
the atomistic and structuralistic conception of consciousness, has d
veloped from the fundamental postulate that there is more in any ps
chological whole than the mere sum of its parts. In germ this system, co
monly known as *Gestaltpsychologie*, or Formalism, may be traced ba

Wundt's (b. 1832) doctrine of mental creative synthesis; which illustrated, among others, by the fact that though one can analyse a tonal lang into a fundamental tone with its overtones, the mere putting of these gether again does not result in the clang. There is more in the latter than e sum of the tonal components. This view was developed by the ustrian psychologists, particularly Ehrenfels, who noted that a large umber of sensory qualities belong to perceived wholes as such, and can-ot be derived from the isolated sensations which enter into them. hus " triangular," " round," "square," are properties of triangles, rcles, squares, as mentally apprehended wholes, and add something to e elementary sensations supposed to constitute them. This " some-ing " is evidently relational in character, as appears even more evidently we consider a melody, which is not a mere collection of notes, but of otes related in a definite manner. Thus, though every single note is tered when the melody is transposed, the tune itself remains unchanged ecause of the " form quality " constituting it. This fruitful conception, riginally worked out with regard to shapes (hence *Gestalt*=German for *ape*, or *form*), was extended to wholes of other kinds; and attention was cussed upon the dynamic mental process by which wholes come to be rmed and isolated. The most recent, and perhaps best-known, develop-ents of Formalism, however, are due to the work of a group of German sychologists (Wertheimer, Köhler and Koffka) who have extended the eory to cover conscious processes other than perception. They have rought forward experimental evidence in its support, and have applied it the interpretation of animal and child psychology with very consider-ble success. Meanwhile, the Austrian school has not been idle either in periment or development of theory ; and, though there are divergences opinion between the two schools with regard to the nature of the mental rocesses involved in the creation of form, both are in general fundamen-l agreement. Though the Austrian school antedates that of Berlin, the tter considers that the principles of Formalism were first stated by ertheimer as the result of his research into the problem of movement pparently perceived when the stimuli presented are not themselves oving. The problem is that of the zoetrope or kinematograph, in which e eye is stimulated by successive pictures representing stationary, but fferent, phases of moving objects, and combines these pictures into the presentation of apparently continuous movement. Wertheimer rightly plained the apparent movement as something over and above the im-essions actually made by the isolated stimuli, and attributed it to a con-gurational or formalising process as immediate as the sensing of the ements which are perceived as already in relation. There are not two ocesses, first sensing and then shaping, as the Austrians hold, in the erception of wholes, but only one. With this modification, the concep-on of form or shape was at once extended to cover all the operations of nsory perception, as well as of thought. Connected with the psycholo-cal doctrine of mentally configured wholes, which has met with wide ceptance, is a physiological one : namely, that there exist connate con-gurational patterns in the nervous system, which are correlated with e mental wholes, and correspond to objectively configured wholes in e environment. These physiological patterns are held to function as response mechanisms. Though based on speculation rather than phys logical evidence, this is a far-reaching extension of psychological theory physiology, and even to physics. Other than psychological aspects Formalism, however, need not detain us here. Having shown that who are, in fact, more than the sum of their parts, it was necessary to co plete the doctrine by showing that they are original, in the sense that other mental items than structured wholes are directly known, and tha is to these we react. Instead of elementary sensations, or the " buzzi booming confusion " of sensations held by James to be the ground fr which consciousness develops, Formalists teach that mental developm starts with structures or wholes, however primitive their character n be. To substantiate this genetically, they point to observations and periments made upon child and animal behaviour. Primitive and inco plex wholes become more complex and fully structurated in virtue of *Principle of Precision*, whereby they " tend to become as perfect as p vailing conditions permit." This not only accounts for our tendency perceive, say, an incompletely drawn triangle as a complete triangle, also shows how learning takes place in the animal, child and adult by creasing structuration of wholes and the inclusion of new elements wit them. The old view that learning comes about by slow associative p cesses of trial and error, during which pleasurable or successful reacti are stamped in so as to become habits, while unsuccessful or painful o become eliminated, is supplanted in Formalism by a doctrine of insigh learning. New wholes are suddenly apprehended ; a new structurat occurs, or a new element is incorporated into the situation, with con quent changes in reaction. Many examples of the working of the Princi of Precision are given in Formalist literature. Köhler's observation of behaviour of his chimpanzees is classic. Faced with problem-situati in the attainment of goals (*e.g.*, food), they overcame the difficulties behaviour which displayed insight. To cite examples, one gifted a whose fruit was too far from the bars of his cage to draw in with a sh bamboo pole, happened by chance to fix two bamboos together, and u the artificially made " tool " to fish the food into the cage. Once he thus chanced upon the solution, he perceived the means towards the g insightfully, and thereafter was able to fit bamboo poles together to g his ends. His reaction to the situation had altered. In the Formalist ex nation this means that the whole situation (cage, food, sticks, etc.) become enriched by the integration of the two-poles-joined-together v the rest. Indeed, he had already perceived this enriched whole when unsuccessfully tried to push one stick in line with the other towards fruit. The sticks were not joined together, but the solution was indica Though the ape stumbled on his solution by chance, he at once percei the tool appropriate to the situation. Learning in this respect was c plete. Other instances are given to show that insightful solution does always arise by chance, but by scrutiny of relations. And several exam are advanced, in which the difficulty of breaking up one whole, and ceiving its parts as integrated in another whole, is brought out. Thus ape, able to use a box to reach fruit hanging high up in the cage, did make use of it when another ape was lying upon it. It was then a " res place," not a " means for reaching fruit." When her companion had fa

f the box, however, she at once grasped it, carried it under the goal,
ounted, and seized the fruit. Köhler notes also, in illustration of the
me point, that the following situation proved very difficult. The fruit
y outside the cage ; there was no stick in sight ; but a dried tree with
anches stood at the back of the cage. The difficulty lay in " releasing "
part (branch) from one whole (tree), and transferring it into another con-
guration. While it was in the configuration " tree," it could not be ap-
ehended as a tool. A similar account is given of learning in human
eings. A child comes to dread the fire, not by association of painful ex-
erience with the visual appearance of fire, but because the relatively
mple fire-whole suddenly becomes more completely structured and
eaningful, calling for a new reaction. Meaning thus grows in more
imitive, but already meaningful, wholes by further structuration. It
not created by experience, but merely transformed by it. Rignano has
inted out that serious difficulties beset this account of meaning and its
owth. He stresses the part played by our emotional attitudes in the de-
rmination of what shall be object-wholes for us, and of our conative dis-
sitions in the fixing of their meaning. A chair is a unitary whole to sit
, a part of a drawing-room set, or the like. And he insists upon the share
at experience has in contributing both to wholes and their meanings by
ay of association. It seems to be clear that the concept of association
nnot yet be dispensed with in psychology, however much Formalism
s contributed to the advance of the science. The greatest contribution
Gestalt to contemporary psychology, however, is undoubtedly its
gorous protest, supported by a wealth of comparative and experimental
idence, against the insufficiency of associationism. Not only are mental
jects originally perceived as meaningful wholes which grow by structur-
ion, but they are wholes perceived in relation to goals to be attained,
d so explain behaviour. Thus purpose is implied from the outset of
ental life. Although Formalists have almost entirely neglected detailed
udy of feelings, emotions and will-acts, in this respect their theory will
in with hormic psychology, to which it makes serious contributions
the cognitive side. Nevertheless, though implying conative activity
roughout, and emphasising cognitive activity in the tendency to per-
ct configurational wholes and to enrich them with meaning, it stops
ort of any real mental creativity, either in thought or behaviour, which
ight take us beyond the sphere of sensory experience. Unlike the be-
viourist principle, that of Formalism would seem to have little practical
plication to the development of character and the guidance of conduct.
hough it is no doubt true that " the larger the wholes and the greater
eir unity, articulation, and meaning . . . the more personality will they
press," the claim that an explanation of personal development is ulti-
ately given by means of the universal law of *Gestalt* alone needs further
bstantiation ; for it would appear that subsidiary principles also are
quired to construct a complete psychology of personality.

PSYCHO-ANALYSIS

Since the third type of contemporary psychology has an article to
elf in this volume, it will only be necessary to refer to it very briefly.

Psycho-analysis, popularly perhaps the best known of current psycholog systems, embraces a number of theories which have grown up aroun method of investigating and treating mental disorder. It originated in practice of hypnosis, during which it was found possible to bring to li the original occasions of certain pathological derangements in neur patients, and so to cure them. It was subsequently discovered that hypnotic state was not necessary in order to secure curative resu Emotionally charged memories, though normally forgotten, could be covered by appropriate treatment during a state of ordinary relaxati and discharge, or working off, of the emotion then effected a cure. point of departure for the analysis was found in the dreams of the patie An elaborate theory grew up around these observations ; and it has b extended from pathology to cover the psychology of everyday life. In first place, the release of emotional tension of which the patient was wh unconscious pointed to an unconscious, yet active, region of mind wh influenced both consciousness and behaviour. This point became capital importance in the theory. In the second place, great resistance frequently encountered in carrying out the analytical technique ; a which led to the formulation of the theory of " censorship." The conc tion is that of an active, repressive factor tending to secure the ma tenance of the unconscious in its unconscious state. An indication of functioning of the same mechanism was also found in the distorted fo of dreams ; which were interpreted on good evidence as disguised ma festations of unconscious wishes. According to the view taken respect to the inheritance of acquired characteristics, the unconsciou regarded as entirely individual or partly racial in origin ; and the cens ship, once conceived as the result of conscious social and moral rep sion, is now, at least in part, held to be an integral force of the unconsci mind itself. Theoretically systematised by Freud, psycho-analytic d trine is presented as a mechanistic determinism on purely naturali lines. Conscious events are determined by unconscious ones which ne may, or never can, come to awareness, and yet are psychical activit Personality is rooted in the unconscious rather than in the conscious mi And, though full use is made of the principle of association to explain derivation and transference of forms of behaviour and thought from t unconscious motives, the fundamental explanatory principle of the s tem is that of the dynamic nature of the unconscious. Whether this is drive of sex or the will to power, whether it is unique or manifold, dif according to the interpretation of different authors. But all alike definit infer from the empirical evidence the two capital points of me activity and the extension of this beyond the sphere of awareness. W Formalism, dispensing with association, provides the mental wh grasped by the mind, Psycho-analysis, in common with Hormic psyc logy, indicates the activities making use of them.

The three contemporary psychological systems just considered are in fact, exclusive, but are mutually supplementary. All are based u empirical observations, and are typically dynamic. All are concerned w the explanation of behaviour. But whereas one finds this in orga mechanisms and their conditioning without recourse to mind, anot discovers it in the integration of conscious " configurations " and gro of meaning, and the third in the profound depths of the unconscious. Each view has contributed to the development of current psychology. Native reaction-patterns together with the alterations wrought in them by conditioning ; the conception of active configuration in percept and memory, as well as in the behaviour to which these give rise ; the extension of the essential character of consciousness to the unconscious—all hese have been incorporated into psychological theory, or at least have profoundly modified the outlook of the present day.

THE "TWO FACTOR" THEORY

A fourth system, incorporating the vital parts of the foregoing, has ecently been developed within the field of experimental psychology. During the past twenty-five years, psychologists the world over have been nvestigating so-called " intelligence " and devising means for its meaurement. Obviously, there can be no direct measure of such a mental unction ; but the accuracy and speed with which a person's mind works n performing intellectual tasks can be estimated from his output. Even hen there is no natural unit of measurement ; it is possible only to calcuate norms, with their probable errors, from samples of the population, nd to compare the performances of individuals with the norm. In this way a " mental age " can be assigned to them, which may or may not correspond with their real age. Original work in this field was done by inet, who constructed " intelligence " tests to be administered to indiiduals (children) singly. Later, group tests were devised, by which large umbers might be tested at the same time. There was, and still is, much controversy in regard to the nature of " intelligence " ; but statistical considerations have led to almost unanimous acceptance of the view dvanced by Spearman, that whatever shows itself in intelligent beaviour, and is measured by the tests, consists of two factors, the one " g ") a general mental ability involved in all the tests, and the other a pecific ability which differs according to the character of the particular st employed. To illustrate by a rough example, we might say that there a common general factor of consciousness both in seeing and hearing, ut a specific factor (eye or ear) involved in each performance. Using a rge battery of varied tests, the specific factors tend to cancel one nother, and a relatively pure measure of " g " may be obtained. Experiental and analytic work has shown that some tests are more " saturated " ith " g " than others ; and that it is best conceived as pure mental energy orking through different engines. What is it that characterises indiiduals who are gifted with general mental ability ? The results of an mmense amount of mental testing, running into millions of cases, show at they score highly in tests which chiefly involve three mental prosses, deriving from three basic laws or principles of original cognition. hey score in the tests (1) when the mental items involved come quickly nd clearly to awareness, (2) when relations of various kinds between the ems are quickly and clearly noticed, and (3) when, such relations being pplied to such items, correlated items rise quickly, clearly and accutely before the mind. All these processes are characterised by insight ; nd they are exclusively the ways in which new knowledge, as distinct

from remembered or recalled knowledge, arises.[1] The principles accou
ing for these processes have been termed by Spearman, who formulat
them as providing a complete account of the genesis of knowledge, *Pr*
ciples of Noegenesis. They are expressed as follows. (1) " Any lived
perience tends to evoke immediately a knowing of its characters a
experiencer." (2) " The mentally presenting of any two or more char
ters tends to evoke immediately a knowing of relation between them."
" The presenting of any character together with any relation tends
evoke immediately a knowing of the correlative character." Briefly, kno
ledge arises from experience ; relations are grasped within knowled
the application of relations to items of knowledge generates new ite
Of these principles the last is astonishingly fruitful. It can take us
thought beyond any previous experience, even beyond all possible
perience. To it are due scientific hypothesis and invention, as for insta
the transfer of the perceived relation of steam and kettle-lid to the c
ceived situation of steam in a boiler in order to work an engine. It accou
for artistic creation in every sphere of art, and even for concepts wh
have never entered into experience in any way, such as those of infin
eternity or God. While all the noegenetic processes are expressions
mental activity and even creativity, the third thus expresses creativity
an especial manner. But the noegenetic principles, though accounting
the origin of knowledge, do not cover the entire cognitive field. And i
the claim of the system we are examining that it is explanatory of all c
nitive process. The noegenetic principles do not explain remembering
forgetting, variations in clearness of mental items, differences in origi
mental endowment, or power of controlling thought. Five further pr
ciples of a quantitative kind are accordingly necessary to complete
account of cognition. The first is one of constancy ; every mind ma
tains a total simultaneous output, which may vary in quality but tend
be constant in quantity. This principle, illustrated by the limitation
mental span, restates the two-factor doctrine. An individual's gen
mental energy tends to be constant, but is available for different ope
tions. Next comes the principle of retentivity, manifested both in ine
and facilitation of mental processes, under which head the old law of as
ciation is included. Mental items experienced together tend to be
tained and experienced together again. The reverse of this is the princ
of fatigue, which summarises the tendency of a mentally experien
event not to occur again. These two principles together express the su
mated effect of earlier upon later experience. The fourth principle is t
of conative control. By willing and striving we can alter the direction
intensity of our knowing. Lastly, there is the principle of primordial
tencies, indicating those original individual differences which are
ultimate personal conditions of the functioning of the others. These
quantitative principles, together with the noegenetic laws, form a fra
work of explanation into which it has been found possible to fit e

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[1] The following test illustrates all three processes : " Complete the sent
' Smoke is to fire as finger-print is to . . .' " No answer can be given unless
meanings of "smoke," and "fire" and "finger-print" are grasped, the rela
of " sign " obtaining between " smoke " and " fire " perceived, and
relation applied to " finger-print " to generate the item required.

variety of cognitive process hitherto examined. It must be noted that the noegenetic, or qualitative, principles are stated in a purely psychological way without reference to physiology, whereas the quantitative principles, while capable of similar statement, are given physiological consideration as well. In respect of the three processes in which experience, relations and correlates become known, the psycho-physical connection is utterly obscure, and no help is afforded by physiology in their explanation. This is not so with regard to the quantitative principles, except in one case. Though they express psychological tendencies, physiology is able to throw some light upon them. The two aspects should, no doubt, be kept separate ; but neither science can here afford to ignore the other. Most interesting in this connection is the recent work of Lashley, which indicates a general energy resident in the nervous system and available for use in various directions. This is an exact physiological parallel of the psychological doctrine of the two factors. The one exception, emphasised by Spearman, is the principle of conative control. Recent experimental investigation of will-acts (*see below*) supports his view. It points to a distinction between conation and volition. Now, the dependence of a conation (say, to move a limb) upon a will-act to do so is as utterly obscure as the passage of experience into knowledge ; and physiology has no useful explanatory suggestion to offer the psychologist in the matter. The problem, like that of the origin of knowledge, remains a purely psychological one. Indeed, this was already indicated in the statement of the first noegenetic principle, where the experiencing subject is asserted to be one of the objects of which we tend to become aware. This subject is very intimately connected with his will-acts which according to the evidence appear to be absolutely effortless precursors of conations of a physiological as well as a psychological character. We have, then, in this system a general mental energy presented which, at least to some extent, can be directed at will from one kind of operation to another. The well-investigated phenomena of inertia, mental lag or perseveration, and of oscillation (or " fluctuation of attention "), are aspects of this same energy. It works in various engines to produce different cognitive results. The engines, in Spearman's view, are provided by the nervous system, so far as ts function is localised ; and this, coupled with his doctrine of the nature of noegenetic process, leads him to suggest that the chief purposes subserved by cerebral localisation are sensation, movement and retention. The roots of the mind ramify in physiology ; its branches, flowers and fruits, so far as we at present know, have no physiological implications. There remains one point to complete the picture. In this presentation of psychology we have energy and engines ; but there is also an engineer. The investigation of the former will indicate the conception we are to orm of the latter ; which, in the writer's judgement, is the keystone of a personalistic psychology.

THE DEVELOPMENT OF CONTEMPORARY PSYCHOLOGY

The contemporary systems of psychology, which have so far been onsidered, are scientific in the strict sense of the word. They do not ttempt ultimate, but only proximate explanations of phenomena ; they

simply investigate behaviour, or the mental processes underlying b
haviour. Even on the cognitive side, however, many experimental da
have been gleaned for deeper philosophical consideration. The esse
tially dynamic character of mental process, activity in the formation a
completion of configurated wholes, activity in the region of the unco
scious, creativeness in the operation of noegenetic laws, the central po
tion of the self in the psychological synthesis : all these positions, alrea
gained in science, point to the lines upon which a philosophy of hum
personality must proceed. In this we shall be reminded of much ancie
speculation. For the pendulum, heavily weighted now with empirical a
experimental data, is swinging backward again in contemporary thoug
from materialistic and physiological explanations of mental phenomena
spiritualistic and purely psychological ones. We can trace an ascendi
spiral on the record of psychological history ; and at each higher point
the curve the restatement of the old animistic doctrine takes on a mo
refined and substantiated form. To-day epiphenomenalism (the vi
that mind is a by-product of matter) need hardly be taken serious
The issue is between parallelism of and interaction between mind a
body ; and contemporary psychologists appear to be about equally
vided upon that issue.

THE WILL

This consideration leads us directly to the topic of conation, or mind
its aspect of active willing and striving. Here again contemporary scho
have arisen as protests against associationism, structuralism and ph
nomenalism. Already, as far back as Maine de Biran, a theoretical doctri
was advanced to account for the origin of habit, will and consciousness
self in a genetic manner. It was an attempt to explain volitional conscio
ness as consciousness of self upon empirical lines, which would
across the mechanistic conception of the followers of Hume. Biran h
that the self was essentially an experiencing activity of a spiritual kin
and he explained how it becomes aware of itself as such. In the first
stance, certain reflex activities are mechanically determined by exter
stimuli. But, on repetition of stimulation, experience divides into t
orders, that of active self and that of object to which the self reacts. I
self as will, especially when effort is experienced in the exercise of
activity upon objects, which is revealed to us. William James also stres
the feeling of effort in “ the slow dead heave of the will,” as well as
fiat (“ let it be so ”) which distinguishes the highest form of will-a
from all other processes of consciousness. Of recent years, howeve
great deal of experimental work has been carried out upon problems c
nected with willing and striving, the results of which fit in well with
findings of Hormic psychology and psycho-analytic theory. This work
mainly followed the two methods of controlled introspection and
estimates. Beginning with researches upon choice carried out in
laboratory of Wundt, the first method was perfected, both with regar
choice of problems for attack and in technique, by a group of work
largely influenced by Külpe. Notable among these are Ach and Micho
The first named, investigating the resolutions taken by his subjects

carry out prescribed mental tasks, found that the true will-act occurs at the moment of resolution, and not in the subsequent performance. The latter, he found, was conditioned by the previous volition, and took place in virtue of what he called a " determining tendency " brought about by it. These volitional determining tendencies are assimilable to native, or instinctive, dispositions in that they may operate without further conscious guidance or control. Ach was able to induce very strong resolutions in the course of his experiments, which aimed at measuring the strength of the will when pitted against strong associative tendencies. His subjects were required, say, to find rhymes to syllables which had so been learned over and over again with others that, when re-presented, there was an almost irresistible tendency to react with the associated syllables. What he really measured, if anything, was not the strength of will-acts, but that of the associative against the determining tendency. Nevertheless, his work shows that conative activities are called into being by the will. Further experimental investigation has emphasised the distinction between conation and volition, and shown that, while great effort may be involved and experienced in striving, acts of will may be entirely effortless and yet effective. Ach's fine introspective analyses further prove that the experience of resolution is in an intimate way bound up with the lived experience of the self ; which can be characterised only by the description " *I* truly will." Thus volition, in its form of resolution, is a peculiarly impressive manifestation of self-activity. Here are gains for psychology of the greatest importance ; the introspective isolation of will-acts, their clear distinction from feelings of effort, and the definite relating of volitional process to the active self.

Similar results were obtained by Michotte, who investigated the process of voluntary choice. In his experiments the subjects were required to choose, for good reasons, between alternative arithmetical operations to be carried out, between different combinations in pairs of pleasant and unpleasant liquids, one of which had to be tasted, and the like. As in Ach's experiments, it was found that the choice-process developed under the influence of volitional determining tendencies set up by the previous acceptance of the instruction (resolution to choose). The choices themelves were capable of analysis on broad lines. Though exceedingly complicated processes, fairly definite phases were distinguishable in them, uch as the perception of the alternatives, evolution and deliberation of motives, development of feelings, and finally consent to, or designation f, the alternative chosen. The subjects distinguished two typical kinds of hoice, cold and lively, and it was found that the " cold choices " were he more voluntary of the two. But these were precisely those choices in which the feeling of effort was least apparent ; and the introspections to his effect were borne out by the objective controls (breathing records, tc.), which showed " lively choices " to be accompanied by considerble physiological disturbance. This observation further emphasises the istinction between volition and conation, to which reference has been made. As has already been stated, the whole process of choice may take lace automatically in virtue of the previous resolution to choose ; but here occurred many cases in which will intervened during the choice self. When this happened, the experience of self-activity, as in the case

of Ach's resolutions, was reduplicated in what Michotte terms " cor
sciousness of action." This is an important result of Michotte's invest
gation ; for it points again to the phenomenal appearance of self in cor
sciousness, an experience sharply differentiated from the consciousness
effort which may accompany it. Once more self, as will, is indicated
an experience entirely distinct from feelings of physiological origi
Experiments similar to those of Ach and Michotte have been carrie
out in the laboratory of the present writer, with results which confir
their conclusions ; and correlation of the introspective reports wi
psycho-galvanometric records taken during the researches corroborat
the distinction, exceedingly important for theory, between volition ar
conation. Where effort is reported, the galvanometer indicates bodi
change.

Research of another kind was carried out by Webb, who used t
method of estimates. His problem was to discover what characte
qualities tend to be found together in individuals ; and to this end he h
a large number of persons ranked in order, by competent judges, in r
spect of different character-qualities which they displayed. Only tho
rankings were used in his conclusions when several independent judg
agreed in their estimates closely enough to obtain a good " reliability c
efficient " (*i.e.*, when high agreement obtained between the ranking
Having obtained his data in this way, Webb calculated statistically t
tendency of certain traits of character and intelligence to be shown in t
same individuals. He found that the moral and social qualities of pe
severance in face of obstacles, kindness on principle, trustworthine
and conscientiousness are qualities of persons whose intelligence is pr
found rather than quick ; whereas readiness to become angry, eagerne
for admiration, and bodily activity in pursuit of pleasure, character
those persons whose intelligence is quick but not profound. He th
showed that a general will-factor exists which reveals itself in characte
and he concludes that consistency in conduct results from deliberate w
ing. Webb's data might have been interpreted in another way, as poi
ing to the general factor of perseveration already established by previo
work. Stability in character might not be due to will, but to men
inertia. His conclusion, however, is supported by further investigatio
made by Lankes, who used the methods both of experiment and estimat
Having obtained rankings for character-qualities similar to Webb's,
also tested for perseveration, and correlated his results. The event prov
that consistency of conduct, or perseverance, is not perseverati
The latter is a native character of the nervous system ; the former
result of a person's own effort and will. Lankes sums up by say
" the self, with persons used to act . . . from higher motives of reas
and principle, not according to merely natural bent and inclination .
can modify, and directly counteract, its own nervous system and its
nate tendency towards perseveration or the opposite."

It will readily be seen how the two lines of attack upon the problem
will lead to similar and mutually supplementary results. A large field
opened for further exploration ; but already the gain is recorded of
aspect of self which is fundamental. It is a self which enters experien
as an essentially active and controlling reality, largely directing its o

behaviour, and irreducible to a mechanical system of sensations or neural processes.

FEELING AND EMOTION

If the field for work upon the will is large, that for the investigation of feeling and emotion is still larger. The psychology of emotion is in a far less advanced state than that either of cognition or conation. To begin with, there is a difficulty with regard to the meaning of the term emotion itself. Sometimes it signifies conation, sometimes feeling, sometimes a blend of both. Until more exact analysis is forthcoming, there is bound to be confusion. From very early times two chief views have claimed adherents ; one, that emotion is a mental state which leads to conation, the other that bodily conation is experienced as emotion. The two views are contrasted by James, who advanced the latter, in a well-known passage :—“ Common sense says, we lose our fortune, are sorry and weep ; we meet a bear, are frightened and run . . . the more rational statement is that we feel sorry because we cry . . . afraid because we tremble.” James picturesquely over-emphasises the rôle of the skeletal muscles in emotion; but visceral and glandular changes must principally be taken into account. The elements of both views are implicit already in Descartes' doctrine of the passions of the soul. Like all conscious processes, emotions are thoughts, not bodily states. None the less, they are perceptions of changes occurring in the body. Physical impressions conveyed to the brain bring about bodily changes which result in seeking, avoiding or defence reactions. In the lower animals this is all that happens. But in man the mind perceives the bodily “ commotion,” and so experiences “ passion.” Emotion is thus a conative adjustment of the body perceived by the mind. But it is more than this. It is also an incentive to acts of will, which in turn influence movements of the body. It is accordingly not merely, as for James, a mass of bodily sensation, but a dynamic mental tate lying midway between knowing and doing. Interesting in this connection is Wundt's emotional theory of will. Elementary feeling-qualities arried by sensations become fused in higher and higher “ emotions ” which develop in regular sequences, and usually lead to acts of will. These latter consist in those emotional sequences which end in a feeling f resolution and lead to overt action. Since consciously willed acts tend o become mechanised and unconscious in us, Wundt extends the conept of will to cover all purposeful action whatever which satisfies bioloical needs. Thus his emotional theory of volition includes both impulive and reflex acts, which genetically once expressed conscious wants of he organism, but now simply connote a typically emotional sequence in which the feeling of resolution is absent. Will as emotion is thus an entirely eneral and fundamental character of mind. A similar rôle assigned to motion will be recalled from what has been said of Behaviourism, in hich theory both natural and acquired reaction-patterns are regarded as ctivated by external stimuli. Here the conative aspect of emotion is ressed to the exclusion of the feeling aspect ; and will is reduced to mere hysiological striving. In sharp contrast with this last view is that of the ormic psychology developed by McDougall. Here emotion is made the ntral part of the instinctive process, which is initiated by perception of connately adapted stimuli and issues in definite conative activities leadir to observable behaviour. Both on the perceptual and the conative sid modifications may occur which explain the complexities of acquire forms of behaviour ; but the emotional core of instinctive and acquire behaviour is fundamental in the theory. This view leads to the exceec ingly important conclusion that emotion is the clue to behaviour, as indicates the natural springs of action. By the play of cognitive proce upon these through the emotions, character may be built up and condu may to a large extent be guided ; and it is by stimulating the natural nee and wants of human beings in this way that the success of applie psychology in all its branches depends. The investigation of the physi logical changes connected with emotion, though of less psychologic interest, has proceeded apace. Since the time of Lotze, who was one the first to examine changes in facial expression, bodily posture, alter tions in breathing and pulse, under emotional stress, many investigatio of this problem have been undertaken. In general, it may be said th these point to the autonomic nervous system, the lower centres (thalam and basal ganglia) of the brain, and the endocrine, or ductless, glands, more particularly concerned in emotional reactions. The work of Langle Head and Sherrington on neural processes, and that of Brown-Séquar Cannon and Crile on the secretions of the ductless glands, may be cit in support. Especially interesting is Cannon's investigation of the fun tion of the adrenal glands. He showed that fear and rage excited in anima provoked the secretion of adrenalin, with consequent increase in blo pressure, liberation of glycogen from the liver, and heightened stimul tion of striped, or so-called " voluntary," muscles. This indicates a con tive set in the animal, fitting it to react with greater vigour to the obje which provokes fear or rage. But the question still remains open wheth these changes are the cause or the effect of the mental state. One indic tion of a possible answer lies in the temporal sequence of events. Some the physiological changes are very slow, and all require time. In expe ments upon will-acts, using the psycho-galvanometer as control, t mental attitude seems certainly to precede the physiological one as i dicated by the deflections of the needle. This would appear to show tl the conative part of the response takes place definitely before the expe ence of the " emotion." Here, again, there appears to be evidence of t essential activity of mind, as already instanced in the creative activit of thought and the controlling aspects of conation.

PERSONALISM

Before passing on to consider the applications of psychology to pr tical life, it will be in place here to suggest, in the light of the foregoi analyses, a view which has been shaping itself in contemporary thoug with regard to the nature of the feeling, thinking and willing subje Those psychologists who are not so " departmentalised " as to exclu consideration of the deeper problems of their science, are coming realise that analysis, though a useful and even necessary method, bre up in thought what is in fact indivisible. The conception of consciousn as a mosaic of sensations, or products of mental chemistry, has be

bandoned. Functional psychology has been substituted for structuralism.
Since Herbart, polemic has waged fiercely against the theory of faculties
intellect, memory, imagination, etc.) as unitary functions, until definite
xperimental evidence has been adduced that no such functions exist.
The notion of man as a collection of separable instincts, of personality as
he integration of native and acquired reaction-patterns, or modes of be-
aviour, is beginning to lose favour. In place of these abstract products
f analysis, stress is laid upon the undivided totality of the person as an
rganic whole, all of whose reactions are purposive. This is personalistic
sychology ; and it has taken several forms. Most interesting is Stern's
iew that scientific psychology and personalism go together. For Stern, a
person " is a being which, in spite of the multiplicity of its parts, pre-
ents a real unity, having a character and value of its own. Thus, notwith-
tanding its many subordinate functions, a person is in fact a unitary and
urposive self-activity. It is, however, psycho-physically neutral, lying
eyond its physical and mental manifestations, either of which may be
nterpreted mechanistically or teleologically. For, in Stern's view, the
ntagonism between mechanism and teleology is reconciled in a teleo-
nechanical parallelism. Moreover, a person's " disposition " is a single
nner factor which co-operates with external factors, and thus manifests
self in a series of single tendencies and characteristics. This doctrine
s the philosophical basis of Stern's scientific treatment of individual
ifferences ; to which subject he has contributed experimental results of a
ery high order. While Stern's purposive self-activity is beyond its mani-
estation, other personalists maintain that it is actually lived and appre-
ended in self-experience. This is the conclusion of much experimental
ork by such investigators as Dürr, Katzaroff, Michotte and Ach, to
ome of which reference has been made above. As actually experienced,
e self, according to Calkins, exhibits four principal characters. It is
nsciously self-identical ; it is consciously unique, consciously related as
round to its own experience and also in many ways to its environment.
hese characters, together with that of its activity, provide a clue to the
nception we should frame of it. Is it matter ? Is it spirit ? Is it a com-
und of both ? Clearly it is not matter in the old sense in which matter
as conceived as an inert substratum for quantities and qualities. Modern
ysics itself is abandoning that concept for one of energy, which it has
rrowed from psychology. Clearly it is not matter in the sense of mere
tency ; for that is a contradiction of all experience. As clearly, it is not
irit in the sense that it exhibits no physical phenomena ; otherwise there
uld be no communication between selves, nor interaction between a
f and its environment. We are driven back upon psycho-physical in-
raction or parallelism, with an altered value put upon both the terms
ychical and physical ; for the reality lying behind physical phenomena,
d the psychical as given in experience, appear to be assimilable in the
m of energy directed towards ends, aimed at goals, one kind of which
least is evidently self-conscious. Whether this personalistic view be ac-
ptable, or, as in other philosophical interpretations of the facts ad-
nced by different schools of psychologists, pure spiritualism or pure
terialism is to be preferred, one thing is pragmatically certain, since,
fact, it *works*. This is, that the discoveries of contemporary psychology

are applicable with advantage to the practical affairs of everyday life. T science is not only a theoretical, but also an applied one.

The principal directions in which psychology has already proved value in application to practical problems are those of education, mec cine and industry ; though its applicability has proved to be possible other spheres also, such as those of law, commerce and social organisatio

APPLIED PSYCHOLOGY: EDUCATION

During the modern period, at least as far back as Herbart, psycho gical knowledge has been employed in the service of education. The do trine of apperceptive masses indicated lines upon which educatio practice should proceed. The child should gradually and progressively supplied with information which is easily assimilable to the backgrou of knowledge already possessed. Moreover, in this process his own pow of observation should be trained ; for information is not simply pou into his mind by the teacher, he must acquire it for himself. Pestalo and Froebel insisted on this aspect of training, not neglecting charact formation, the latter especially emphasising the value of vivid stim (colours, playthings, etc.) in attracting and securing attention. His the of education by the play-method led to the institution of the kindergart and has further been developed in the Montessori system. But ot problems demanded attention also. The discarding of the doctrine faculties raised the question of the possibility of “ transfer of trainin Does training in one subject, or skill, facilitate the learning of anoth Does learning Latin, say, make learning Greek easier ? Or does pract in manipulation with one hand help in the acquisition of skill with other ? It was found that such facilitation only occurs when the sev subjects or skills concerned are very similar in character ; a fact wh has largely influenced educational curricula. A like problem arose in resp of memory. Is this a unitary power, good or bad all round ; or do pe have good memories for some things and bad for others ? Again, resea has shown that “ memory ” consists in a number of memory-functio and that the degree of functional unity is connected with the degre likeness of the material remembered. Thus, though retentiveness va from one individual to another, it is incapable of general training. On other hand, work initiated by Ebbinghaus and prosecuted by a la number of investigators shows that there are advantageous method memorising and acquiring skills. In general, for example, learning wholes is more economical than learning by parts ; spaced-out lear is better than learning all at once. These conclusions also have b fruitful for educational practice. Even more important, however, been the discovery of the possibility of measuring general mental abi as well as certain special aptitudes, by the use of intelligence and o tests. This not only permits of children being graded for teaching ap priate to their mental age, but also gives indications of special abil which would benefit by intensive training, or the lack of such abilitie children upon whom training would be wasted. On the character sid contrasted with intelligence, much headway has also been made in ap ing psychological knowledge to problems of maladjusted, naughty oublesome children. Emotional and conative defects, lack of control, id wrongly formed habits are, to a large extent, amenable to treatment ; id the multiplication of highly successful child-clinics for this purpose evidence of the educational and re-educational value of applied psychogy.

APPLIED PSYCHOLOGY: PSYCHOTHERAPY

This last consideration indicates a connection between educational psyiology and psychotherapy. Just as maladjusted children can be successilly readjusted by psychological means, so many forms of neurosis yield psychological treatment. From time immemorial psychology has in one ay or other played its part in the practice of general medicine. Plato retes how Socrates described the cure of headache by suggestion, and the arliest records of Egyptian medicine show how psychological principles ere used in effecting cures. Psychotherapy is to-day a recognised branch f the medical profession, specialising along definite lines in the treatient of functional, and sometimes organic, disease of mental origin. The iief methods in use are those of suggestion during hypnosis or in the ypnoidal state, psycho-analysis and re-education. By such means not ily phobias (fears), compulsions (irresistible impulses), tremors, tics id morbid habits, such as alcoholism or drug-addiction, may be cured, ut even serious physical conditions may be ameliorated. Apart from denite curative suggestions and catharsis, or mental purging, however, the ifluence of emotional states and conative attitudes upon physiological rocesses is well known ; and the skilled practitioner draws upon general, well as special, knowledge and technique in his therapeutic procedure.

APPLIED PSYCHOLOGY: INDUSTRY

Among the latest developments of applied psychology is that connected ith industry. It has at length come to be realised that human beings, as ell as machines and materials, are involved in production ; and that invidual differences are of the greatest importance in adapting people to e various avocations of industrial life. Some employments require much telligence, others less. As we have seen, individuals may be tested for neral mental ability and advised in respect of, or selected for, tasks hich are suited to their capacity. Again, perseverative tendencies, which ake for slowness in adaptability, would be a great handicap in some sks, whereas a strong perseverator would perform others with ease and ccess. This general factor can also be tested, and advice given or selecn made accordingly. Similarly, many special aptitudes which fit or squalify people for particular forms of work can be investigated by sting. In this way, a fairly complete picture of the individual is reached, far as possibilities of performance are concerned. There are some jobs which he can never make good ; in others he may prove a success. That will not certainly be successful in these depends on other factors than neral and special abilities of a cognitive or executive kind. Human begs are not machines, nor even intelligent machines. Their emotional d conative make-up must also be reckoned with. Their needs, desires and feelings constitute a no less important consideration than th abilities in fitting them for different employments ; and individual ferences in these respects also must be taken into account, not only vocational guidance and selection, but in their subsequent occupatio career as well. Here, again, psychology has much to offer to worker, ployer, distributor, salesman and even consumer. Investigations h been carried out upon the best ways of performing different tasks, the troduction of rest-periods between spells of work, the lessening of hours of the working day, the avoidance of fatigue and boredom, the vision of adequate incentives to arouse ambition, and the like ; and results, when applied, have proved to be advantageous to all concern Greater production has been secured with less effort, fatigue and e tional disturbance. Though here, as elsewhere, psychological research application have begun with problems of the head and hands rather t of the heart, an immense field is opened up for further work. Our creasing knowledge of will and character-qualities will be found as app able to industrial conditions as our knowledge of intelligence and spe aptitudes has already been ; and the legitimate needs and desires of hu nature, even when they differ, will be taken into account in industrial ganisation. An illustration may already be found in the psychology of vertising and salesmanship. Clearly these can be practically successful so far as they are based upon knowledge of the desires and motives wh lead people to purchase goods. It is not enough to catch attention b striking poster or paragraph, and to hold it by repetition. A mere scription of an article by a salesman will not sell it. The prospective p chaser must want to buy, or be made to want to buy, by an appea need or desire. He must be given a motive to purchase which will sufficiently strong to sway him. The appeal through the eye or the ea not so much to his judgement as to his feelings. By further extensio this principle, applied psychology can go far both in industry and c merce. It can reach to professions or callings of every kind. Indeed, th is no sphere of life that it cannot touch. For to control our own thoug feelings and actions, and to adapt ourselves to our place in the so organism, some understanding of human nature, as manifested in selves and in others, is required. We must know those points in which are alike and those in which we differ. Most of us learn a little of knowledge in a rough and ready way through experience of ourselves others in our various social contacts. But a detailed and exact knowle is only possible through scientific observation of the facts and their perimental investigation. We end with the definition with which we beg Psychology is the science which investigates behaviour in general, f the point of view of its mental implications, and with a view to its gu ance and control.

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THEORIES OF PSYCHO-ANALYSIS

By

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SYNOPSIS

sycho-analysis is a branch of psychological science which has at- acted much attention in recent years. Starting as a method for treat- ent of nervous disease, it soon opened up new and important fields psychological research, which had hitherto been inaccessible to thodox psychology. Though many of its conclusions have been hotly ntested, it has nevertheless exercised, both directly and indirectly, very great influence on modern thought, so that some knowledge the subject is indispensable to those who would view the chief ndencies of present-day culture in their proper background and rspective.

the first section of the following Article will be found a brief treat- ent of the historical evolution of psycho-analysis ; its origin in the oneer work of Breuer and Freud, the remarkable series of discoveries which it led in the hands of the latter investigator ; the founding the psycho-analytic movement, which has for many years possessed international organisation ; the divergent doctrines of Adler and Jung, who, from being originally followers of Freud, eventually tablished separate schools of their own.

he second section gives a systematic account of the chief concepts psycho-analytic science ; the nature of the Unconscious, the func- ns of repression, the significance of sex, symbolism, conflict, urosis and sublimation.

the third section the development of mind is considered in the ht of psycho-analysis. An endeavour is made to show how psycho- alysis can explain much, both of individual character and of human lture as a whole, on the basis of the mechanisms of displacement d sublimation. Consideration is also given to the startling new velations of psycho-analysis concerning the foundations of our moral —revelations which are likely to be even more far-reaching in their cial influence than were the earlier discoveries concerning the im- rtance of sex. Finally there is a brief indication of what would seem be the general significance of psycho-analysis for the future of man life and human society.

THEORIES OF PSYCHO-ANALYSIS

I

THE NATURE OF PSYCHO-ANALYSIS

Meanings of the Term

Psycho-analysis is a term that has carried a number of meaning some legitimate and others not—and in approaching the subject it is v to be clear as to the nature of these meanings. In its widest sense the te has sometimes been used to designate almost anything within the dom of psychology. This is a meaning that was due solely to the indiscreti of publishers and journalists, anxious to sell their books or to gain attention of readers by reference to a doctrine which, because novel a startling, was supposed to have a popular appeal ; it is a meaning whi fortunately and rightly, is seldom to be met with nowadays.

In a more restricted, but still misleadingly wide sense, the term sometimes used to denote the work of a number of psychological scho which had a common origin, but which have now drifted so wid apart that all members of these schools have recognised that it is hig inconvenient to employ a common designation ; and where the scho concerned themselves agree that a distinction is desirable, it ill beho others to confound this distinction by applying the term " psyc analysis " indiscriminately to them all. The schools in question three in number, and all three owe their origin to discoveries made Professor Sigmund Freud of Vienna towards the end of the ninetee century.

Except for one collaborator in the first stages, Freud worked practic alone, until early in the present century. But from 1902 onwards a sm band of followers gathered round him, resulting in the first Psyc analytic Congress in 1908 and the foundation of an International Psyc analytical Association in 1910. Soon after this latter date, howe two prominent members of the school independently and gradu seceded from it, first by stressing certain particular aspects of psyc analytic doctrine, then by raising objections to other well-establis aspects of this doctrine, and finally by neglect or reinterpretation of th latter aspects on such a drastic scale as to make it very clear that s mutual understanding as is required for profitable co-operation utterly impossible. These members were Alfred Adler and C. G. Ju who thenceforward became the leaders of the schools associated their names—schools which have in recent years been known as thos Individual Psychology and Analytical Psychology respectively. Of th ller's school has the closer organisation and the more coherent body of ctrine; and is, in consequence, more definitely associated with the e it has adopted. Jung's views, though perhaps less systematised (ex- ɔt as regards an elaborate doctrine concerning " psychological types ") d to a lesser extent adopted *en bloc* by a particular body of followers, ve nevertheless exercised a wide influence, particularly in Switzerland eir native home), England and America. In what follows we shall have casion to deal with particular characteristics of both schools. Mean- ile, what concerns us is the fact that the original school of Freud has rsisted and has retained the title by which it has been known since the ginning. At the present day the term " psycho-analysis " is, among chologists and physicians, almost without exception employed only connection with this latter school. There can be no doubt that this ge is the correct one, whether we look at the matter from the point view of historical continuity, of ethical justification or of scientific cision. It is in this sense therefore that we shall understand the term e.

But even from this relatively narrow point of view, " psycho-analysis " mean several things, between which it is possible, at least in theory, distinguish. In the first place it means a method—a method at once of chological study and therapeutic practice. In the second place it means facts discovered by this method. Thirdly it signifies the theories that ve been propounded to explain and correlate these facts. Lastly it is d to designate the application of the psycho-analytic method, view- nt and theory to facts obtained otherwise than by the direct observa- n of the individual—facts which, in actual practice, have been collected m very wide and varied fields.

n our exposition we shall study, first the method, and then the facts theories. For the sake of brevity it will be necessary to describe the s in conjunction with and in the light of the theories, and not—as uld for strictly scientific purposes have been preferable—to explain in ail how the theories were devised to fit the facts. To adopt the latter rse would necessitate a detailed treatment of the whole development psycho-analysis—a task which is far beyond our present purpose.[1] e reader may rest assured however that, unless there is specific warn- to the contrary, use will be made only of such theoretical construc- s as have proved themselves of unmistakable utility and are generally epted at the present day by all competent workers in the subject. In course of our survey we shall have occasion to indicate from time to e some of the chief fields to which psycho-analysis has been applied, ther with the general bearing of these applications, both upon psycho- ysis itself and upon our general conception of the human mind and nan institutions. As befits the character of the present volume, em- sis will be laid throughout upon more general matters of psychological sociological importance rather than upon the contributions of psycho-analysis within the narrower field of medicine in which it t its origin.[1]

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[1] detailed consideration of the validity of psycho-analytic findings and of general scientific status of psycho-analysis will be found in the present r's chapter on "Psycho-analysis; Its Status and Promise," in *Psychologies 30* (1930).

Development of Psycho-analysis

The history of psycho-analysis is usually taken to date from cer observations made by Josef Breuer of Vienna in the early eighties of century. Whilst treating a remarkable case of hysteria he discovered the many strange symptoms of the case had a meaning, in the sense they referred to certain forgotten (but, at the time they occurred, hi emotional) past experiences of the subject—and furthermore that these periences could be brought back into consciousness by suitable suggest or communications in the hypnotic state, and that, when they were brought back, the symptoms vanished (at least temporarily) and a ger alleviation of the patient's condition could be brought about. The that hysterical symptoms had a meaning and depended upon cer buried memories had already been made clear by Charcot and his p Janet in France, but the curative effect of the recovery of these mem in consciousness had never been clearly demonstrated, and Breuer's covery seemed to open up new prospects for a psychical therapy that not directly dependent upon the effects of suggestion. On returning a period of study with Charcot in Paris, Freud joined forces with Br for a time and persuaded him to publish the material which he had b to collect some ten years earlier. In 1893 was published the first paper of the two collaborators, to be followed in 1895 by a book ent *Studies in Hysteria*, which constitutes the first great contribution t literature of psycho-analysis. This book, which was based upon a nu of penetrating clinical studies, contained the germ of psycho-an theory and the description of a method of treatment which is still ap in psycho-therapy, though it no longer forms part of the orthodox cedure of the psycho-analyst. This method consisted essentially i recovery of pathogenic (*i.e.*, disease-producing) memories in the hyp state and (a point which, early in the work, showed itself to be of importance) the re-experiencing in consciousness of the approp emotions. This re-experiencing or working-off of emotion was te " abreaction," and the method itself was called the " cathartic " (pu or clearing) method, since the patient appeared to be purified and from disease-engendering material as a result of this procedure. underlying concept thus revived the idea long ago expressed by Ari with regard to the function of tragedy, which, he held, brought ab healthful " purging " by intense arousal of the emotions of " pity " terror." Breuer soon gave up this line of work, to which he had i never brought the same interest as his younger colleague. Freud how ontinuing alone, soon modified the procedure and devised the psycho-nalytic method proper, as it has continued until this day. Following the rocedure of the French schools, the production of the hypnotic state of nind had hitherto been regarded as an indispensable condition of the eatment. Freud's great step was to abandon hypnosis and to find a new nethod that could take its place. He gave up hypnosis, in the first instance r practical reasons, because—like other investigators—he found it ould not always be induced; secondly, because the capricious and often comprehensible results of hypnotic treatment displeased him as a ientist. He early obtained the impression that by the use of hypnotism rtain difficulties or obstacles were evaded rather than overcome. This ight in some cases be satisfactory, so far as immediate therapeutic fect was concerned; but it was very dissatisfying from the point of view medical and psychological science, which seeks, not only to cure, but understand the principles of cure. It was clear, however, that ordinary rocedures in the waking state were powerless to produce either under-anding or alleviation of the patient's troubles. If these troubles had a ental origin and a meaning explicable in psychological terms—facts of hich by this time Freud was fully assured—this origin and meaning ppeared to be quite inaccessible to consciousness. Something in the ructure of the mind seemed to bar the way to understanding. This arrier had somehow to be overcome, if the true nature of the symptoms as to be elucidated. It was to meet this difficulty that the psycho-nalytic technique was gradually evolved. By a series of approximations, hich we need not stop to detail here, Freud developed the procedure free association, which has ever since remained the chief weapon of the sycho-analyst and the essential feature of the psycho-analytic method. his method consists in asking the patient to abandon all conscious con-ol and direction of his thoughts and emotions and to say everything that mes into his mind without hindrance or criticism. Absurdly simple as is may sound, and simple as it is indeed in theory, it is yet very far om easy in practice. It constitutes a radical departure from the speech bits of everyday life, in which we are (with good reason) constantly ntrolling and adapting our words and thoughts in accordance with the cumstances of our environment. The nearest approach to such a men- attitude as is required is that of reverie or day-dreaming (a condition hich we regard as quite peculiarly private and unsuitable for communi-tion to others). Day-dreaming apart, there is always some task to complish, some line of thought to pursue, some special pre-deter-ned chain of association to follow up—all of them circumstances in hich, checking our tendency to " wander," we have constantly to keep ention upon the matter in hand. Even in social small talk, in which the gical sequence of ideas towards a goal gives place to a more unrestricted aming along the chance paths of phantasy or recollection, there is al-ys some limit to our freedom, necessitated by the claims of intellectual evance, emotional congruity, or respect for the feelings and emotions our fellows (as will be easily realised, if we imagine ourselves trying to d an opening for some favourite joke or story). In free association for rposes of psycho-analysis even this degree of control must be aban-ned, the subject being instructed to say literally everything that occurs to him, even though it appear inappropriate, senseless, shameful, gusting or even rude—even though, in fact, the saying of it may inv a complete flouting of all the intellectual, moral, æsthetic and so canons of our thought and speech. Let the reader try the process for a few minutes, and (if he is honest) he will rapidly convince himself the procedure is a socially “impossible” one, and that he has alre begun to edit or censor his associations, for the sake of his own feeli or those of his collaborator. Indeed even in the special conditions of analyst’s consulting-room the procedure is at best only partially hered to; the process of analysis constantly meets with “resistanc which interrupt the flow of associations. Sometimes these resistances of a conscious order and manifest themselves in a deliberate refusa put into words some idea that has arisen. At the other extreme the pat is sometimes temporarily unable to progress, in spite of his most ear conscious desire to do so. In such cases he may correctly assert tha “cannot think of anything,” that his mind has “become a blank,” cept perhaps for some slight awareness of his immediate physical e ronment; or else, as if in flight from more important matters, he prattle away about a quantity of insignificant events connected with daily life. In either case a strong impression is received that there is s mental force impeding the entrance into consciousness of emotion toned associations—a mental force that may sometimes appear in sciousness as disgust or embarrassment, or may sometimes itself rem unconscious. Here, as so often elsewhere in the sphere of mind, ther moreover a continuous gradation from the clearly conscious to the de itely unintrospectible, so that there arises a strong presumption in fa of the view that there exist unconscious resistances which in their gen nature are somewhat similar to those that we observe in consciousn

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[1] Those who wish to study in greater detail the strictly medical aspe psycho-analysis will find thorough but condensed treatments in Ernest *Treatment of the Neuroses* (1920), and John Rickman's *Development Psycho-analytical Theory of the Psychoses, 1893–1926* (1928). The psycho-an method itself as applied for therapeutic purposes is described in greatest by Edward Glover, *The Technique of Psycho-analysis* (1928).

In spite of these formidable difficulties, however, the method showed itself to be capable of results of great psychological interest therapeutic value. With its help a great fund of information concer the nature of the mind and of mental development (normal and path gical) has been gradually accumulated. The most astonishing featur the whole history of psycho-analysis is the vast field on which its dis eries have thrown a vivid light. Starting as a means of dealing with me disorder, it soon revealed the fact that there was little essential differe between so-called “normal” and “abnormal,” and that the proce shown to be at work in the patients’ minds could be paralleled in al every detail by those of healthy individuals; a slight alteration in balance of forces could account for the whole difference between he and disease. Certain special types of mental process also began t illumined by the new method. Dreams, for instance, which had long a source of inspiration to the superstitious and of puzzlement to learned, were shown to present many striking resemblances to phenomena of the neuroses (or functional nervous disord Indeed the analysis of dreams soon began to play an important pa actual treatment. They constitute, as Freud has said, the *via regia* to unconscious, and his advice to those who would obtain some ins into the real nature of psycho-analysis is that they should study own dreams by the method of free association, starting from the va

ms of the dream in turn, and noting the ideas and emotions that spon-
eously arise when conscious control of thought is abandoned. The
xt matter to be investigated was that which was christened by Freud
" psychopathology of everyday life,"[1] the little forgettings, mistakes
l slips of which we are all guilty at some time or other, and which he
wed to be frequently determined by unconscious mechanisms of the
ne general nature as those which are responsible for the more per-
nent pathological disturbances that we term neurotic. The problems
wit and humour were then, in turn, attacked. Here, too, many of the
ne mental processes were shown to be at work, and psycho-analysis
ceeded in throwing much additional light upon a field which had al-
dy been extensively cultivated by philosophers and psychologists.
ere followed excursions into the domains of art, literature, history and
nost fruitful of all—anthropology. It is from the study of primitive
ys of thought as embodied in the myths, beliefs, superstitions and
ctices of savage peoples or in the corresponding survivals among
ilised races that there have come at once the most striking corrobora-
n of psycho-analytic theory and the most far-reaching applications of
psycho-analytic method. The corroboration from this field (as from
t of history) was particularly welcome, since there was here no possi-
ty of the supposed discoveries of psycho-analysis being in reality in
nature of artifacts created by the suggestive influence of the physician
l his own beliefs—a possibility that has been much stressed by critics.
like the discoveries made in the consulting-room, the data obtained
m anthropological, literary and historical sources are fully available
ll, so that the material on which the psycho-analyst bases his conclu-
ns can be examined and assessed by others in a way that is not possible
he case of the material gained from the actual study of individuals by
method of free association, where much that is conclusive to the analyst
ally present at the time is difficult to present in convenient and con-
cing form to others.

f the corroboration of psycho-analytic findings from these wider fields
done much to establish the scientific respectability of psycho-analysis,
wide vistas that have been opened up have shown in clearest fashion
immense importance of the psycho-analytic view-point for an under-
ding of the whole structure and function of human culture. The
chological mechanisms originally discovered by Freud in his
sulting-room seem to have so wide an applicability that there is
cely anywhere a religious belief, a ceremonial observance, a social
itution or a conventional practice that does not bear their imprint.
heory it was clear from the beginning that the social sciences, such
nthropology, sociology, politics and economics, should be based upon
chology (much as engineering is based on physics, and medicine is,
hould be, based on physiology). But, in practice, psychology had
wn itself very slow in providing the foundation on which the social
nces could build. Both academic psychology of the more philosophical
and the more recently developed experimental psychology were

The more convenient word " parapraxia " has recently been introduced as
neral term applicable to this field.

largely concerned with problems so abstract, or else so specific, that had little relation to the affairs of everyday life. Psycho-analysis how was, from the first, concerned with the more concrete thoughts and e tions of individuals actually struggling with life's difficulties—difficu moreover with which, in one form or another, all humanity has ha contend. Freud tells us that he ultimately came to realise that he had whole of mankind for his patient. It would seem indeed that there be no field of human endeavour, however great or small, concerning w we cannot receive profitable enlightenment from psycho-analytic cepts. Hence the great importance of a general understanding of t concepts, in the interest of human welfare and progress.

We will accordingly pass now to an examination of certain of the theoretical conceptions of the Freudian psychology, to which the section of this Article will be devoted. The third section will deal the general process of mental development seen in the light of those ceptions and of the present state of our empirical knowledge, whi a few final words we will return to deal briefly with the general signific of psycho-analysis for modern culture.

One further word, however, is necessary before we embark on programme. It is a word of caution which the title of this Article m especially imperative. Psycho-analysis is not, and never has been, a oretically perfect structure. Contrary to what has often been supp Freud and his fellow-workers started with no fixed conceptions o nature and function of the human mind or of its disorders. Their the have rather been in the nature of working hypotheses erected as scaf ing, indispensable for the further work of building. They have add and modified these theories as this work has proceeded, but no att has ever been made to give them the dignified structure of a comp edifice. On the contrary they show, ever and again, evidences of a n shift and temporary character. Psycho-analytical theory as a whole day a rapidly growing body of doctrine. Its more recent developmen however, shown that the foundations of some thirty or more year were well and truly laid, and indeed we have good ground for supp that the theory, as it exists at present, does not contain much tha later be regarded as definitely erroneous, though it will undoubtedly to be looked upon as seriously incomplete. This, however, is the ut that we can demand of any extensive theoretical structure in the of science.

II

THE NATURE OF MIND

Repression and the Unconscious

In the forefront of psycho-analytic doctrine stands a certain ge assumption as regards outlook and method—the assumption of wha been called *psychic determinism*. By this is meant the belief that the l cause and effect is as operative in the sphere of mind as in that of m Where introspection fails to reveal an adequate *conscious* cause of a m content, it is assumed that unconscious mental factors are operative is assumption that theoretically justifies, and is in turn empirically cor- borated by, the method of free association. The method is in fact based the belief that, when conscious control of the sequence of thought is andoned, unconscious factors take over the control, and express them- lves as best they can in the ensuing conscious ideas and emotions.

This brings us to the most general and fundamental of all the concepts psycho-analysis concerning the nature of the mind—that of the *Un- nscious*. It is of course a concept which existed before the advent of ycho-analysis, and has indeed long been familiar both to philosophers d psychologists. Freud's use of the concept is, however, somewhat fferent from that of the great majority of his predecessors, and in its tailed application he has gone far beyond them all. Most of the earlier iters arrived at the concept of the unconscious through a study of know- dge; to these writers the unconscious seemed necessary to account for e phenomena of thought and perception, and, above all, of memory. his apparent necessity, which was felt by so many students of the mind, came much clearer and more urgent as a result of the work on hyp- tism and psycho-therapy in the second half of the nineteenth century. his work had demonstrated the frequent occurrence in pathological cases mental dissociation, a splitting up of the mind into two or more mutu- y inaccessible parts; parts which, in some instances, might even develop to "dissociated personalities," though in other cases the dissociated ements might be confined to a few isolated sensations or memories. ich cases of dissociation were accounted for by Janet (in whom this ork may be said to culminate, and who is by almost universal admission e greatest living figure in psycho-pathology after Freud) on the hypo- esis of a lack of "tension" or cohesive force, as though a reduction of e available energy made it impossible to hold all the varied portions of e mind together. Freud conceives of these dissociations, not in terms lack of some general energy, but rather on the ground of some specific tagonism or opposition between the dissociated parts. His conception the mind is essentially dynamic. He regards striving or conation (to e the generally accepted psychological term) as the real function of nd, and the opposition between different parts of the mind can, he nks, best be expressed as a conflict between inconsistent and opposing ntal tendencies or "wishes." Thus the primarily intellectualistic con- pt of the unconscious, that was prevalent before psycho-analysis, gave ce to a primarily dynamic concept. In this point, as in many others, eud has revealed himself as the scientific successor of the great pessi- stic philosophers, Schopenhauer and Hartmann, rather than of his mediate psychological predecessors; we say "scientific" successor to phasise that in his outlook he has (at any rate throughout his earlier rs) been consistently more empirical than they, though the philo- hical affinity between the three great thinkers is unmistakable.

Conflict then, according to Freud and his followers, is the essential se of functional nervous disorder and of the dissociations so frequently nected with it. But this view of dissociation soon led to a distinction ween two apparently different ways in which a thought or memory ght be unconscious. A fundamental feature of the human mind, on ich many psychologists have commented in wonder, is the extreme

narrowness of consciousness at any given moment. Of all the pos
things which we could think, remember or perceive, only a minute
tion can enter consciousness at one time. The rest must wait till s
external fact, some chance association, or some consciously directed
sire, enables them in turn to occupy the stage. When their turn co
however, they are ready to appear. It is otherwise with those though
memories which are dissociated, and which have been shown to be
cerned in the production of neurosis. In their case no external stimu
no voluntary effort, can avail to bring them into consciousness ; this
only be done (if at all) by the help of some special procedure, suc
hypnotism or free association. It is as though some barrier or obs
made them inaccessible, in a way that ordinary memories are not. Al
psychic material of the first class Freud designates the *Pre-Conscious*.
second class he calls the *Unconscious*, employing the word in a sp
" systematic " sense.

Although the unconscious in this special sense (a sense which wi
adhered to throughout this Article) plays an important part in the
duction of mental disorder, its importance is by no means confine
pathological cases. It is rather an essential constituent of every hu
mind, and, as already implied, it seems intimately connected with
occurrence of mental conflict, another feature which is common bot
the diseased and to the healthy. It would appear, in fact, that one o
results of mental conflict is that certain thoughts and tendencies ma
forced, as it were, into the unconscious (or, in other words, that they
be prevented from reaching consciousness). This process of active ex
sion from consciousness is called *repression*, a term which, there
designates a particular kind of that general controlling function w
is known to psychologists and physiologists as " inhibition." It sh
be noted that repression itself is an unconscious process—it is not a
liberate and voluntary pushing out of the mind, though it is undo
edly analogous to this process, with which we are all conscio
familiar.

We may here, in passing, call the reader's attention to the fact tha
his later writings at any rate, Adler has discarded the notions both o
Unconscious and of Repression—notions which are fundamental to
whole of Freud's psychology. We mention this to show how confu
and illegitimate it would be to designate the two now so different sch
by one and the same name.

But if repression is one important outcome of conflict, it is far f
being the only way in which a conflict may be solved. Indeed comp
repression, in the sense that a mental tendency disappears utterly and
ever, is a theoretically limiting case to which, in actual practice,
certain approximations can be observed. There is every reason to bel
that a wish is never completely annihilated by repression, but th
continues to exist in such a form that it is ready to seize any opportu
for expression that may present itself ; indeed it is only through the
tinued vigilance of the repressing forces that it is prevented from en
ing consciousness. These repressing forces (which in their totality
called by Freud the *Censor* ; a term which—because of its anthr
morphic associations—has been much criticised by English writers)

ss active in sleep, and the repressed tendencies (many of them dating om the first years of life) are enabled to express themselves in dreams. is this which makes the dream, as Freud has said, the *via regia* to the nconscious. But such manifestations of the repressed as we detect in eams are in most cases not direct, but distorted, expressions of the iginal wish ; and it is in this point that dreams so much resemble neutic symptoms. Whence comes the distortion ? From the action, it would em, of the Censor, who—like his social prototype—will allow certain cts or views to be expressed, provided they are suitably veiled, so as not be easily recognisable for what they truly are. The dream product (the anifest dream content, as Freud designates it, to distinguish it from the tent dream thoughts), like the neurotic symptom, reveals itself, then, as compromise arrived at as the result of the interaction of conflicting forces -repressing and repressed.

It is one of the paradoxes of the development of psycho-analysis that, the present moment, much more is known about the repressed tenncies than about those which are responsible for the repression. In the rlier statements of the psycho-analytic theory, the repressions were garded as resulting from the fact that the repressed tendencies were ot in harmony with the moral consciousness of the individual or with e personality as a whole. It was generally believed, moreover, that the titude of the Censor was more in harmony with conscious standards of ought and conduct than was that of the repressed wishes. It should erefore, one would imagine, be more accessible to investigation than ese latter. With increasing insight, however, it became apparent that is was only to a slight extent the case, and that the morality of the Censor , in reality, itself largely unconscious, differing in important ways from at of the conscious ethical outlook. The element of paradox was thereby moved, though at the same time a complex and difficult series of fresh oblems concerning the nature and origin of this unconscious morality as opened up. We can deal with these problems more conveniently at later stage of our considerations. Meanwhile we need only, by way of ticipation, state—baldly and dogmatically—three results of recent instigations in this field. In the first place there has been evolved a new ncept concerning the unconscious morality in question ; this morality regarded as a definite entity within the mind and is called the *Super-o*. It is, as it were, at the behest of the Super-Ego that the Censor does work. In the second and third place the morality of the Super-Ego ffers from that of the conscious Ego in that it is (*a*) relatively archaic epending, that is, upon impressions formed during the early life of the dividual and persisting in a condition that is but little modified by later periences), (*b*) more severe, inasmuch as things that seem right and rmissible to consciousness may nevertheless be disallowed in the unnscious. It is for this latter reason that Freud has made the statement at " the normal man is not only far more immoral than he believes ferring to the repressed tendencies] but also far more moral than he s any idea of [referring to the Super-Ego]."

Aggression and Sexuality

It is natural to ask at this point what are the chief thoughts and t
dencies that are repressed. It is possible to answer this question qu
shortly, without any serious sacrifice of accuracy ; the repressed mate
is, in the great majority of cases, either hostile or sexual in nature, w
the latter category (so far as our present knowledge goes) very consid
ably predominating. That this should be so need not astonish us. F
granted that the process of repression exists, we should surely anticip
that hostile and sexual impulses would more often succumb to the proc
since the most superficial reflection on our present culture is sufficien
convince us that the conditions of this culture constantly demand
control and inhibition of such impulses. How many times, even in a sin
day, are we not compelled to curtail or dissimulate the natural express
of our irritation at life's petty frustrations, humiliations and annoyanc
But, over and above these trivial sources of bad temper, there are lo
standing and quasi-permanent causes of hostility (such as those oc
sioned by the necessity for co-operation or cohabitation of persons
tween whom there exists rivalry, jealousy or incompatibility of views
temperament), for which no adequate outlet can be provided. It is th
latter sources of hostility, especially those connected with early life, wh
psycho-analysis has shown to be especially important as regards rep
sion. The frustration of the sexual impulses demanded by our pres
(and perhaps indeed by any) civilisation is even easier to realise, if
devote a little candid introspection and observation to the subject. Nev
theless the revelations of psycho-analysis concerning sexual repress
and the nature of the impulses that are repressed have aroused m
incredulity and opposition than any other of its discoveries.

The Freudian doctrine of the nature and development of the sex
instincts is so important for the whole theory of psycho-analysis that
shall reserve it for more detailed treatment in the next section. We r
here note, however, that the widespread antagonism encountered by th
results of psycho-analytic research are only such as are to be expec
if the psycho-analytic theories themselves are true. In individual pati
the process of making conscious the repressed tendencies meets, as
have noted, with very great resistance. But individual patients are, as
have also noted, by no means the only persons to suffer from repres
—a mechanism which appears indeed to be a universal characteristi
mankind. We have therefore every reason to anticipate that, to the hu
race as a whole, the showing up of the general nature of the repre
material in psycho-analytic literature will be no more welcome than is
uncovering of their buried thoughts and impulses in the case of those
actually submit to the process of analysis. The well-nigh universal
dency to oppose the conclusions of psycho-analysis, a tendency wh
has manifested itself throughout the history of the movement, so far f
affording an argument for the unconditional rejection of these conclusi
actually affords some evidence in their support.

We have said that the impulses which meet with the most frequ
checks are those concerned with hostility and sexuality. One of
important differences between the school of Freud and that of Adler

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erhaps be said to concern the relative importance attributed to the in-
ibition of these two impulses respectively. Quite early in his history as a
sychologist, Adler began to attach a greater importance to the frustration
f the tendencies of individual self-assertion than did Freud—a tendency
hat was not unconnected with his own rebelliousness in general and his
ttitude to the founder of psycho-analysis in particular; for concerning
his attitude Freud has recorded the significant words of his one-time
isciple: "Do you believe that it is such a great pleasure to me to stand
a your shadow my whole life?"[1] Some of Adler's first and most in-
eresting observations concerned the "inferiority of organs" and the
sychological reactions thereto by way of compensation: by which he
neant the tendency to over-compensate for a natural defect by developing
ne corresponding faculty so that the individual concerned eventually
ecomes superior in just that respect in which he was originally inferior—
doctrine which is undoubtedly of great truth and value, and which is
xemplified in the well-known story of Demosthenes, who, from being a
tammerer, became one of the greatest of orators. From this beginning,
dler continued to develop the doctrine of self-assertion by way of the
masculine protest" (the aggressive assertion of virility), until it soon
ecame the all-absorbing element in his whole system. Psycho-analysts
ave not denied the importance of the factors to which Adler drew
ttention; and, indeed, they have themselves in recent years devoted an
ver-increasing attention to the ego elements, but their generally critical
ttitude towards his doctrines has been based upon the contentions:—
a) that, by neglecting the unconscious, together with nearly all the com-
licated details of mental functioning which had been so laboriously dis-
overed by psycho-analysis, he has given an inadequate account of that
art of the mind which he has treated (thus he fails to make sufficiently
ear the fact that many of the original inferiorities—stammering, for
stance—were themselves the result of deep-lying inhibitions, and that
neir over-compensation is in the nature of a "return of the repressed"
a form that is ethically more permissible): (*b*) that his psychology
together overlooks the importance of the erotic aspect of life, and is thus
sentially and inevitably one-sided. According to his system, the impulse
aggression is all-important, there is no room for love. As Freud has
marked, it is a cheerless aspect of life that is presented; but, as the
ample of innumerable ascetics shows, almost anything is acceptable, so
ng as sexuality is kept at bay—a task in which Adler's psychology is
most as successful as was academic psychology before the advent of
ycho-analysis. Our task here is not to criticise Adler's psychology or
y other, but to expound psycho-analysis. Some brief indication of the
stinctions between the two systems is however imperative, and this
st approach to the subject of sex seemed the natural place to attempt
ch indication. Lest it be said that Freud's "pan-sexualism" (a term
at has sometimes been used by his critics) is no less one-sided than
dler's insistence on the ego, it is only fair to remark here that Freud has,
ne and again, emphatically stated his belief that the sexual tendencies,
ough of immense importance, do not exhaust the instinctive equipment

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[1] S. Freud: *History of the Psycho-Analytic Movement* (1916), p. 42.

of man, and that psycho-analysis has in the course of its developm continually broadened the range of its observations and its theories, wi out thereby sacrificing the earlier acquisitions. Adler's Individual P chology on the other hand has become more and more rigid in its acc on aggressiveness as an all-pervading and all-important factor, and h with ever greater determination, set its face against the intrusion of sex or other influences.

Symbolism

The view of psycho-analysts that repressed material is very largely a sexual nature is rendered all the more unacceptable to the majority people by a further aspect of their doctrine—the importance that th attach to sexual symbolism. As we have already noted, repressed i pulses seldom exist without making themselves felt in consciousness some way or other—though the way may be so indirect that the t underlying meaning is often not appreciated ; indeed this lack of app ciation is often an essential condition of their manifestation. Now one the most important of these indirect ways of manifestation is that symbolism. Not the least of the achievements of psycho-analysis is t it has led to a realisation of the widespread use of methods of expressi whereby sexual or other inhibited material is portrayed in such a that it is not immediately or easily understood. We have said that psyc analysis is responsible for the " realisation " rather than for the " covery " of sexual symbolism, for the reason that the discovery of symbolism had already been made by students of religions of the E and elsewhere : students who had—above all—endeavoured to make c to an incredulous world the wide importance of the phallus in m aspects of religious ceremonial. Psycho-analysis has proved that sy bolism of this kind is not confined to primitive peoples or to the civil tions of the East, but that it appears to be a general characteristic of human mind. Indeed one of the most valuable contributions of psyc analysis has been to show, here as elsewhere, that the same phenom can be observed in many different aspects and products of the mi Actually, it was in their study of dreams that psycho-analysts first countered symbolism ; but, as the work proceeded, it soon became parent that precisely the same symbols, with the same interpretat could be discovered in religion, language, ceremonial, myth and f story. There still exist many fascinating but unsolved problems connection with symbolism,[1] problems which we cannot deal with h In particular, it is still uncertain how far symbolism results from rep sion, or how far repression merely leads to the employment of a mod expression which has come into being for quite other reasons. Ther considerable evidence to show that symbolism is a necessary and evitable feature of the primitive mind (and therefore also of the primi layers of the cultured mind). But that there is the closest connection tween symbolism and repression, is indicated, not only by the stud

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[1] The fullest treatment is that of Ernest Jones in *Papers on Psycho-Anal* 3rd edition (1923).

numerable individual cases, but by the general fact that the field of
terest that would seem to be most universally repressed—namely that of
x—is also the field with which the majority of symbols deal.

In symbols, as in every case of indirect expression, there exists a
ental relation between the symbol and the thing symbolised. The ease
ith which this relation can be discovered varies greatly, however, from
e case to another. As a case where the relation is fairly plain, though
vertheless of such a kind as to escape recognition by the vast majority
those to whom the symbol is familiar, let us take the wonderful lamp
Aladdin, which will afford the gratification of every wish. Here it
ould be plain enough, once it is pointed out, that the lamp itself is a
mbol of the phallus, and the happiness to be derived from it (by the
propriate magical gestures) a scarcely veiled allusion to sexual grati-
ation. But why a lamp ? The middle term is here supplied by the idea
warmth and fire, which seem always and everywhere to be associated
th love, passion and sensuality, as is shown in such common expressions
" on heat," " a warm embrace," " an ardent affection," " hot stuff,"
a burning desire " (with which compare " a frigid woman " and " a
illy reception ") and in the innumerable rituals in which fire plays a
rt, from the religious creation of fire (by friction) among primitive
oples to the lamp-lighting ceremonies of certain present-day societies.

As another transparent example let us take the well-known rhyme :—

I had a little husband no bigger than my thumb,
I put him in a pint pot and there I bade him drum.

ken literally, this is almost complete nonsense ; interpreted sym-
lically as the act of coitus, the meaning is perfectly clear. This inter-
etation of the total idea is, moreover, borne out by the frequent oc-
rrence of the individual symbolisms involved. The " little husband " is
ase of the " little man," dwarf or gnome as a representation of the
allus, of which Rumpelstiltskin and Punch are among the best-known
mples ; the process here being a substitution of *totum pro parte* instead
the still more usual one of *pars pro toto*. The thumb as phallic symbol
n example of the general tendency to substitute a more harmless
tion from the upper part of the body for the more emotionally signi-
nt but relatively unmentionable parts of the lower trunk—a tendency
t is perhaps especially manifested in dreams. The pint pot is an
mple of the very numerous cases where a vessel, receptacle or enclosed
ce serves as a feminine symbol, as contrasted with the complementary
s of phallic symbols.

et us now take two more difficult cases to contrast with these. There
considerable amount of evidence to show that a cloak or mantle may
n serve as a phallic symbol. Here there is no similarity of outward
n between the symbol and the thing symbolised. So different do the
things seem that it is almost unimaginable that such a symbol could
e been consciously elaborated in accordance with a pre-conceived
ry (thus affording additional evidence for the truly empirical basis of
psycho-analytic views on symbolism). As far as the evidence at
ent available goes, it would seem that the missing link is here to be

found, once again, in the notion of warming, which is of course
function of a cloak.

Scarcely less obscure at first sight is the symbolisation of coitus
means of climbing or walking upstairs. Here the essential comn
thoughts are those of rhythmic movement and the actual position adop
in the reproductive act ; while linguistic usage helps us again by
corroborative evidence afforded by such phrases as “ *un vieux marcheu*
(an elderly *roué*).

Symbols are, as will perhaps have been gathered by this time,
tremely numerous and varied. Nevertheless the number of things sy
bolised is relatively small. They are, without exception, things of h
emotional significance, and include (1) the human body or certain p
tions of the body, especially the genital regions ; (2) certain bodily exc
tions, such as semen, fæces and urine ; (3) certain persons, especially
father and mother ; (4) certain biological events or processes, especi
birth and death. Among the more important symbols falling into the f
class are long, pointed objects, weapons, knives and other instrume
serpents, fish, Zeppelins, all these being male symbols. The correspo
ing female symbols are hollow and round objects, jewels, gardens
flowers. The process of tumescence is often symbolised by flying, w
the human body as a whole is most often represented by buildings (v
doors and windows corresponding to the bodily orifices), and by la
scapes (with hills and valleys corresponding to the protuberances
depressions of the body—*cp.* the anatomical term “Mons Veneris”—
woods corresponding to the hairs). Dancing, climbing and other rhyth
movements represent coitus, while sliding, and extraction or losing
teeth, correspond to auto-erotic activities. In the second category
find, for instance, that salt stands for seed, money and papers for fæ
water and fire for urine. In the third category there exists a general t
dency to portray the father and mother by more exalted persona
especially a king or queen, though the parents, and especially the fat
may also be represented by certain animals (this latter symbolism link
up such apparently unrelated phenomena as the totemism of primi
peoples and the animal fears of present day neurotic children). In
fourth class, birth is most often represented by going into, or coming
of, water, a hole, a tunnel or a house, while death appears as going o
journey (*cp.* use of the term “ the departed,” the constantly recur
notion of the soul's journey after death and Hamlet's well-known re
ence to “ the undiscovered country from whose bourne no trave
returns ”).

It is clear that symbols of the kind we have been discussing are
certain respects, different from such other forms of indirect represe
tion as that in virtue of which a wedding ring stands for marriage
certain conventional female figures stand for such abstract virtue
liberty or justice. In these latter cases the things symbolised are in
preconscious rather than in the unconscious ; in other words, there i
special difficulty about bringing these things to consciousness. The e
tional elements of the relationship are also strikingly different in the
cases, for, whereas in the first kind, where the thing symbolised is
conscious, its emotional value is greater than that of the symbol, in

cond kind just the opposite holds good. This can be seen clearly in
ose cases where the same object serves as a symbol of both kinds. Thus
serpent may stand both for the phallus and for wisdom, but whereas
e emotion accompanying the idea of the phallus is greater than that
oused by the idea of a serpent, the serpent is itself of greater emotional
gnificance than is the abstract idea of wisdom. Indeed a consideration
the two kinds of symbolism gives us very strongly the impression that
e symbolic process is used by the mind for different ends in the two
ses—that in the first case the aim is to reduce the total emotion by sub-
ituting a relatively harmless and uncensored object for one that appeals
ore strongly to our primitive desires (though at the same time permit-
ng some discharge of our feelings through this indirect channel) ; and
at in the second case the purpose is rather to endow with the additional
stinctive energy attaching to some emotionally toned concrete object an
ea that in itself appeals rather to the intellect than to the passions. The
riter who has devoted most attention to this subject,[1] has proposed that
fferent terms shall be employed in the two cases, that the word
symbol ” should be confined to instances of the first kind, and that some
ch term as “ metaphor ” or “ emblem ” should be used when referring
the second. It seems doubtful whether it will be possible, or even
sirable, thus to narrow the meaning of “ symbol,” and the present
riter has tentatively proposed the term “ cryptophor ” as a suitable desig-
tion for those cases that contain “ hidden ” meanings not ordinarily
easily accessible to consciousness. But whatever term be adopted,
ere can be little doubt of the psychological value of the distinction.

It would seem, however, that we may be compelled to recognise more
an one kind of cryptophor or true “ symbol,” to use Ernest Jones'
rm. In particular it would seem necessary to distinguish between
material ” and “ functional ” symbols. Whereas “ material ” symbols
al with corporal or external objects and events (all the cryptophors that
have so far mentioned are of this class), “ functional ” symbols express
tes and tendencies of the mind. These states and tendencies may be of
emporary or, in extreme cases, almost momentary character (such as the
empt to solve a given problem, or the process of transition from a
eping to a more wakeful state), or may be of a more stable nature, in
ich case the symbols appear to denote permanent and abstract fea-
es of the mind, such as the instincts, the power of moral control, the
dency to return to infantile ways of thought, etc.

It is generally agreed that such “ functional ” symbols occur, but there
a great difference of opinion between psycho-analysts proper and cer-
n other psychologists as to their importance as compared with that of
“ material ” symbols. This divergence is particularly acute as be-
een the school of Freud and that of his erstwhile follower Jung. Dis-
vered in the first place by a special technique devised by Herbert
berer, functional symbols were seized upon by Jung as a means of
ape from what seemed to him the monstrous, repellent sensuality
d infantilism of the unconscious as revealed by Freud. They soon
came the real centre of interest in his researches, and it is in connec-
n with them that most of the distinguishing features of his system had

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[1] Ernest Jones : *op. cit.*

their origin. Instead of studying the individual concrete wishes of
patient, wishes towards particular persons or objects, Jung began to l
everywhere for symbolic representations of general mental tendenc
and above all for symbols of the libido. The term “ libido ” had been u
throughout by Freud to designate the sexual impulse in all its vari
manifestations (a conception with which we will deal later). By Jun
was widened so as to designate the sum total of the creative forces of
mind, becoming thus more or less synonymous with the Bergsor
term *élan vital*. In practice this amounted to a very much smaller emp
sis upon the concrete sexual motives and to a development in the direc
of very wide and somewhat mystical generalisations—a developn
which has seemed to psycho-analysts to involve the abandoning of ne
all the hard-won insight into the nature and importance of the sex
elements of the human mind.

To take a concrete and frequently recurring instance. There are
numerable myths and dreams which portray in somewhat disgu
form the slaying of a father by a son and the love of the son for his mot
—a theme which occasionally finds a relatively open expression, as in
well-known myth of Œdipus. To many followers of the Jungian tr
tion the principal significance of such a theme is to be found in a sy
bolical portrayal of the struggle to overcome primitive, unadapted
immoral tendencies (*e.g.* “ the old Adam ”) and a necessity for a ret
to the depths of the unconscious in order to gather strength for a r
effort—a sort of *reculer pour mieux sauter*. To the psycho-analyst th
meanings might be regarded as quite possible in certain cases, bu
secondary and relatively superficial constructions, which we must
allow to distract us from the underlying “ material ” symbolism, wh
portrays the literal hatred of the son for the father, and the literal in
wish towards the mother. To him the functional interpretations of
analytical psychologists seem to have much the same significance as
interpretations of certain schools of mythologists of an earlier genera
—mythologists who, in accordance with the then popular “ astr
modes of thought, would interpret the murder of Laius by Œdipus
the triumph of the rising sun over the darkness, and the incestuous m
riage with Jocasta as the apparent sinking of the sun into the sea or ea
at sunset. Both tendencies they would regard as motivated principally
the desire to escape the unpleasant implications of the more signific
simpler and more literal meaning. It is for this reason that psyc
analysts have looked upon much of the later work of Jung with very gr
suspicion, though they universally agree that in his earlier years he c
tributed much of value to psycho-analysis itself, particularly by his
sight into the possibilities of the word-association experiment and by
pioneering application of psycho-analysis to certain cases of deme
præcox. The difference in method and outlook between the two sch
has only widened with the lapse of time, and in their later developm
psycho-analysis and analytical psychology have proceeded in alm
complete independence of each other. We shall therefore not be ca
upon to investigate the more recent features of Jung's psychology, s
as his elaborate doctrine of types, which, however important it may
timately prove to be, cannot be regarded as in any sense a produc

sycho-analysis or a feature of psycho-analytic theory. There is, how-
ver, one further point in Jung's psychology which deserves mention
efore we leave the subject. Jung, unlike Adler, continues to make use of
ne concept of the Unconscious. He considers, however, that the un-
onscious is not entirely a personal and individual affair ; over and above
ne " personal unconscious," each individual, according to him, shares in
ne " collective unconscious," in which not merely the form but also the
ontent is determined by heredity. This view implies the old and widely-
bandoned doctrine of " innate " ideas ; it means that our hereditary
quipment is not confined to general tendencies, predispositions and
apacities, but that ideas themselves are to some extent transmitted. If we
ould accept this doctrine, it would of course clear up the otherwise
ifficult problem as to why certain notions so constantly figure in the
nconscious and why symbols nearly always bear the same meaning.
reud himself has been so struck with the frequency and similarity of
ertain " primal phantasies " (such phantasies for instance as castration
r the overhearing of sexual intercourse between the parents) that he too
inclined to consider that they cannot be entirely accounted for in
rms of the individual's own experience. Many other psycho-analysts
owever still hope to explain the uniformities in question on the ground
nat, owing to the similar conditions of life and the similar operation of
ne fundamental instincts, all human beings have necessarily many of
neir deeper interests, hopes and fears in common.

ondensation and Displacement

We said just now that it is generally agreed that functional symbols
tually occur. We might have gone further and asserted that the same
mbolic material may serve at one and the same time in a functional and
a material sense. That such a double significance of a single conscious
em is possible, is due to an interesting tendency of the mind, the far-
aching importance of which Freud was the first to realise. Given, as
often happens, the simultaneous arousal of two desires or inten-
ons, seeking different expressions, the mind most easily deals with the
uation by way of a compromise, in which both elements are to some
tent represented. Examples of this from everyday life are to be found
the " portmanteau-word," the pun and the *double entendre*. This last
ows indeed some superficial resemblance to (cryptophoric) sym-
lism, inasmuch as one meaning is, as it were, paraded for the sake of
spectability, while the emotion is derived from a partly hidden signi-
ance of a less presentable kind. Many symbols, however, together with
any neurotic symptoms, may have two (or more) meanings, which are
th (or all) unconscious. Indeed, resort to compromise of this kind
pears to be one of the striking characteristics of the Unconscious. The
ocess of compromise is called in the technical literature *Condensation*,
hen the fusion is primarily one of ideas ; *Over-determination*, when it is a
estion rather of simultaneous " drives " or wishes.

The ideas or wishes in question may, it appears, have almost any rela-
n to one another. They may be quite independent and unconnected
cept for chance coincidence, or else (and perhaps most usually and

significantly) there may be a certain relation of oppositeness or incompa bility between them. Indeed one of the most remarkable revelations psycho-analysis concerns the frequency with which people harbo simultaneous but irreconcilable wishes, wishes which are in many cas in the nature, not only of logical contradictories, but of contraries, when a person wishes to do and not to do a thing, or wishes to do a thi and at the same time to do its opposite. When two wishes of a direct contrary kind are simultaneously operative, the attitude of the pers concerned is said to be *ambivalent*. The most important kind of amb valence is that which occurs when a person at the same time both lov and hates another person—an attitude which is surprisingly frequent between near relatives, and indeed between all people whom the c cumstances of life bring into intimate and influential relationship w one another.

The scope of this Article does not admit of extensive illustrative a terial, which—in psycho-analysis even more perhaps than elsewhere necessarily demands much space. For such material the reader must referred to the text-books, special treatises and journals devoted to t subject. Nevertheless, since the full significance of over-determination a ambivalence are particularly difficult to realise without some illustrati and since such realisation is essential to a proper understanding of ma of the most essential features of psycho-analytic theory, we may pau here to consider two brief examples—one from the domain of wit, t other from that of dream life.

First the case of wit. Let us take the story of the Englishman w offended against the law of *lèse majesté* in Berlin in the days before Great War. This Englishman held strong and unfavourable views ab the Kaiser, and did not fear to express them to a companion even in street. One day he was overheard by a policeman to make an empha statement beginning with the words "This damned fool of an empe . . ." The policeman quickly arrested him, and informed him of nature of his crime. But the Englishman, with remarkable presence mind, attempted a bold method of escape. "My dear man," he sa "surely you don't suppose I was talking of the German emperor wouldn't dream of talking like that about the German emperor. I h the greatest admiration . . ." But the policeman was not to be so ea put off. "Come, come," he said, "that's no use at all. I know very v whom you meant. There's only one damned fool of an emperor and th ours!" Here the policeman manifests an ambivalent attitude, both wards the emperor and the foreigner. He admits with the Englishn that the Kaiser is indeed a fool; but at the same time he protects latter from the disrespect of an outsider (in much the same way as a n will defend his family honour before a stranger, though he may live private enmity with all members of this family). Contempt and resp are, therefore, both neatly gratified by means of the same formula. He the satisfaction of doing his duty by arresting an impertinent foreign but, by identifying himself with the latter's point of view (and thus some extent sympathising with him), he makes a sly dig at his own perial master (doubtless glad enough of an opportunity of expressin last an opinion which he himself had long held, but never dared to u

-at any rate in the course of his official duties). The over-determination
this case is the essential element of the wit. Similar over-determinations,
ıt more complex in structure, at a deeper level, and with direr con-
quences, would seem to be at work in all cases of neurotic illness.
ssentially the same, but on a still grander and more tragic scale (though
ain not without an element of the ridiculous), are the psychological
echanisms that underlie many of the cherished religious, political and
cial beliefs and institutions of the human race.

To turn now to the dream example. To analyse a dream of any length
complexity would require many pages. Here we will take therefore
very short and simple dream, but one which is well suited to our pre-
nt purpose, inasmuch as it reveals itself as highly over-determined. A
male patient undergoing psycho-analytic treatment dreamt that : “ The
ner had come to tune the piano. He was engaged in taking out a number
seeds from the inside of the piano.” Short as it was, the analysis of this
eam occupied a whole hour’s session, and revealed very clearly the
llowing symbolisations and over-determinations. The dreamer herself
represented by the piano, a choice of symbol that is partly determined
the circumstance that she was a proficient amateur musician (though
r own instrument was the violin) and partly by the fact that she was
ffering from serious worry and overwork at the time of the dream, and
at she had herself, the day before, expressed her longing “ to go *piano*
r a bit,” *i.e.* to take life more easily. This desire “ to go *piano* ” (repre-
nted symbolically by actually being a piano) is the first and most super-
cial wish-fulfilment of the dream. The tuner is a symbol of the analyst
-one indeed that is apt enough, for there is an obvious analogy between
e relation of a tuner to a piano and that of an analyst to his patient. The
eam therefore contains a reference (as so many dreams do) to the
alytic situation itself. But why is the tuner (analyst) removing seeds
om the piano (patient) ? With this question we come to the sexual
ements which are so seldom lacking in dreams, for seed, here as else-
here, refers to the biological processes of reproduction. But the as-
ciations made it evident that there were three distinct meanings within
is general sphere. In the first place seeds refer to certain sexual desires,
ich, as the analysis was making her realise, she had all-unknowingly
rboured in her mind. The analysis, she hoped, would rid her of these,
it seemed to her, evil and unseemly desires. Hence the analyst was
mbolically removing them. This is the second wish-fulfilment. It will
observed that it is one that fits in pretty well with the interpretations
at have been stressed by Jung and his school, for the “ seeds ” may
th some justice be regarded as a symbol of the libido itself (though, it
true, in a narrower and more definitely erotic sense). But there are two
ther wish-fulfilments of a cruder and more instinctive kind. The word
eed ” can be metaphorically used for “ offspring,” and the third mean-
of the dream is that the analyst is acting as the patient’s accoucheur
the birth of a child. Lest the reader be astonished and disgusted, let
n remember that Socrates, who with his motto “ Know thyself ” ap-
rs to have been in some ways very definitely a forerunner of Freud,
ened his own spiritual labours to those of a midwife, who helped women
the birth of children in much the same way as he himself helped men

to the birth of self-understanding. Fourthly, and finally, the dream r presents the opposite of taking out, *i.e.* putting in ; in other words, t analyst is thought of as putting his seed into the patient. Here the reac who is untrained in psycho-analysis is likely to remain incredulous. E before he definitely rejects this interpretation as both unpleasant and a surd, we would mention three sources from which evidence from analc is forthcoming to support it. In the first place the condensation of t ideas of coitus and birth is one that is found to be of very frequent occu rence in psycho-analysis. It is as if the unconscious tended to identify t two processes as marking the two most interesting points, the beginni and the end, of the cycle of gestation, bridging over, as it were, the ni months that intervene. Secondly, as regards representation by opposi (in this case the symbolisation of “ putting in ” by “ taking out ”), must remember that this process is by no means confined to drea (where it is frequently found), but is familiar to us through that conscic expression of humour and hostility that we term irony. Thirdly, as regar the rôle of the tuner (analyst), this is the place for referring to what found to be a constant feature in psycho-analysis, namely that the pers of the analyst becomes invested with a very high degree of feeling, bo of love and of hate—emotions that are derived from the psychologi relationships in which the patient has stood to persons of importance his earlier environment (parents, nurses, teachers, etc., but especially first named), and which in the course of the analysis are temporar transferred to the analyst himself ; whence the technical name for t process, which is called Transference.

To sum up the features of this dream which here especially conc us.—The dream reveals itself as highly over-determined, inasmuch a gives expression to four distinguishable wishes : (1) to get rid of wo and overwork (“ go *piano* ”), (2) to get rid of disturbing sexual desi (3) to give birth to a child with the help of the analyst, (4) to have sex intercourse with the analyst (*i.e.* to receive a child from him). It may noted that the second wish is incompatible with, and may even be garded as the opposite of, the third and fourth.

With these examples in mind, let us return now to our general c sideration of the principal concepts of psycho-analysis. The phenomer of *Transference*, to which we referred just now as a factor entering i the interpretation of our dream example, is by general consent a mat of the greatest importance in the therapeutic aspects of analysis. It occ without exception in every case where the analytical process succeeds getting far enough to overcome the resistances in the initial stages ; a it is essential to ultimate therapeutic success. It is as though, in the cou of the analysis, there took place a living over again of emotional attitu towards the most significant persons in the patient's past life—thou this reliving is now done in relation to the analyst himself, who appe to take on the characteristics of these earlier persons. The emotions c cerned are those of fear and hate, as well as of respect and love—he the attitude of the patient towards the analyst is apt to be highly ambi lent. The reliving of these emotional attitudes is however itself, for most part, an unconscious process—and one of the most difficult ta of the analysis is the conversion of this tendency to repetition into

nsightful remembering, so that the origins of the attitude of the patient
o his analyst are recognised for what they are. In fact the transference
an to some extent be regarded as a new and artificial neurosis, which, in
ts turn, is analysed ; and with the successful completion of this part of
he work, the analysis itself draws to an end. It is the difficulty of inducing
ransference in patients suffering from genuine insanity that appears to be
he chief obstacle to the therapeutic application of psycho-analysis to such
ases.

Transference, which thus plays such an important part in the practice
f psycho-analysis, can in theory be regarded as only a particular example
f a wider process—that of *Displacement*, which can be defined as the
quite general) transference of an emotional attitude from one idea to
nother. The occurrence of some such process has long been acknow-
edged by psychology, and indeed the process is an easy one to recognise
vithout any special training (as when we are put into a bad temper by
omeone who has not acted according to our wishes, and thereafter for
time tend to behave in a curt or irritable way to all who approach us,
owever innocent and inoffensive in themselves). Fundamentally it would
eem to be the emotional equivalent to the law of association in the sphere
f cognition, and indeed it is, to some extent, in its actual working, de-
endent on this law ; for displacement takes place, not in haphazard
ashion (though in certain cases, as in the simple instance just noted, it
nay be very diffused) but, like symbol-formation, according to certain
efinite relations, which can usually—though not always quite easily—
e detected. According to psycho-analytic theory, displacement is a
nechanism of enormous importance for the development of mind ; and
ndeed many of the most valuable contributions of psycho-analysis to the
tudy of mental growth consist in the discovery of the precise nature of
he individual displacements that most frequently occur. It would seem
hat man is born with a limited number of hereditarily determined re-
ction patterns (themselves of varying degrees of complexity and deter-
ninateness) and that, thereafter, as he develops, these reaction patterns
ecome complicated by the facts : (*a*) that any given reaction can be
voked by an ever-increasing variety of stimuli, and (*b*) that it can itself
ogether with its emotional accompaniment) undergo important modi-
cations, so that at first sight the whole reactive process may eventually
ppear to have little in common with its original and primitive form. This
neral view is held by the great majority of present-day psychologists,
cluding even the school which represents the opposite extreme to that
psycho-analysis. Behaviourism (which may be said to occupy that
sition because it endeavours to ignore consciousness altogether), in its
udies of the " conditioned reflex," is concerned with the change in the
ture of the stimulus. Psycho-analysis (which extends the sphere of the
nscious, by analogy, into that of the unconscious) is concerned with the
der aspects of the developmental changes, not only those of stimulus,
t those of emotion and response. It is not therefore in the general
ctrine of displacement, but rather in its particular contributions
the doctrine, that psycho-analysis is distinguished from other
hools of psychology (though the term itself is still peculiar to
ycho-analysis).

In the course of development there are formed certain displaceme of especial social and cultural value. Indeed, if psycho-analytic theory right, civilisation is possible only through displacements of this sort, a result of which the myriad activities of civilised societies gradually evo out of the relatively simple and primitive innate tendencies of man. Su displacements have received the special name of *Sublimation*, a techni term that, unlike " displacement," has found its way into general psycl logical literature, and indeed to some extent into common speech. considerable portion of our third section will be devoted to indicating chief forms of sublimation, as at present discovered by psycho-analy since this constitutes one of the most assured and at the same time c of the most interesting parts of psycho-analytic theory.

Other displacements however seem to be pathological in nature, anc is these that find expression in the various *symptoms* that are characteris of nervous disease. Psychologically a neurotic symptom and a sublin tion have much in common, since both represent a deflection of energ the most obvious difference being that of the relative value for cultu achievement and individual happiness—a difference that is social ethical rather than psychological. But closer inspection reveals a psycl logical difference also. The neurotic symptom appears always to be outcome of mental conflict, and itself is in the nature of a comprom between the opposing forces engaged in the conflict ; like most co promises, moreover, it gives lasting satisfaction to neither party c cerned. It seems to result from an attempt at repression, but an atten that is only very partially successful (the repressed tendencies hav found a circuitous channel of escape ; a channel that often stands in so symbolic relation to the one that was originally sought). The relative fluence of the repressing and the repressed forces varies from one k of symptom to another, and this variation is to some extent a char teristic of the various forms of nervous disease that are clinically dist guished. Thus in hysteria (whether the symptoms are chiefly mental, in so-called " anxiety hysteria," or chiefly physical or sensory, as in " c version hysteria "), analysis of the symptoms reveals for the most p a distorted expression of a repressed wish ; while in " obsessional n rosis " (in which the patient is plagued by compulsive thoughts or actio the symptom seems rather to be in the nature of an over-compensat against the inhibited desire, and thus chiefly gives expression to the pressing forces of the mind. Symptoms of this latter kind belong to class of so-called *Reaction-formations*. The existence of such reacti formations—often, but not always, of an obviously neurotic kind— frequently be recognised in ordinary life. One thinks naturally of two v common types : the shy young person who, in order to overcome timidity and sense of inferiority, becomes somewhat curt, loud, rude blustering in his behaviour ; and the prudish " old maid " who is so c stantly on the defensive against her own repressed sexuality, that scents sex everywhere, and consequently reacts with shame, disgust disapproval, when confronted with words or acts that seem to oth perfectly innocent and harmless.

The element of conflict and repression is much less in evidence in case of sublimations. It would seem here as though the viability of

hannel depended on conditions that are much more stable than those in
eurosis. There is an appearance of smoothness, relative effortlessness
nd lack of friction, that contrasts strikingly with the impression of
truggle and waste of energy that one receives from the study of neurotic
ymptoms. It is as though the sublimated channel were a really adequate
ubstitute for the original and cruder one, and were capable of providing
 gratification which, though different in quality (and often less in in-
ensity) than that of the corresponding primitive impulse, is no less satis-
actory ; the ardour with which people give themselves over to the pursuit
f true sublimations being often but little inferior to that which accom-
anies pleasure of a more sensual kind. Psycho-analytic theory has not as
et definitely committed itself as to how far repressions are necessary for
ne production of sublimation. On the whole the evidence points pretty
trongly towards the necessity of some kind of inhibition of a more primi-
ve satisfaction as a condition of sublimation. But the inhibitions them-
elves are relatively deep-seated and efficient, and (since they do not
nterfere greatly with the quantity, and impose restrictions only on the
orms of satisfaction), they seem to meet with comparatively little opposi-
on, the instinctive energies flowing easily and naturally into the new
ubstitutive channels.

From what has been said, it will be clear that the goal of development
 which psycho-analytic theory points is that of sublimation—a goal
hich signifies at once mental health for the individual and cultural pro-
ress for society. Psycho-analysis has made us realise, however, that the
chievement of sublimation is not an easy task, but is on the contrary an
nd which can only be attained by slow and gradual steps. Neurosis comes
bout largely through a sort of moral impatience on the part of the in-
ividual and society. To achieve the maximum of sublimation we shall
nd it necessary to be more tolerant to the demands of instinct than has
itherto been the case. Sublimation itself is an unconscious process which
 outside the sphere of voluntary control. All we can do is to provide the
eans for its occurrence, remembering meanwhile the inevitable gradual-
ess of the whole process. This is one of the great lessons of psycho-
nalysis, both to the educator and to the social reformer. It is a theme to
hich we shall return in our concluding section.

III

THE DEVELOPMENT OF MIND

eneral Theory of Development

The psycho-analytic theories of mental development are inextricably
ound up with the psycho-analytic theory of sex ; it is therefore necessary
 us to consider together these two aspects of our subject. The psycho-
alytic conception of sex is a somewhat unusually wide one, and includes
ood many processes that are at best only indirectly connected with the
ocess of reproduction. The terms " Libido " and " Sex," as used by
eud, are in fact used somewhat similarly to the " Love " of Christian

tradition or the Platonic “ Eros,” though the psycho-analytic views as the nature and development of “ Sex ” are far more detailed and precis According to these views, normal adult sexuality results from an int gration of a number of what were originally more or less independe impulses—technically termed *Component Instincts*. Perhaps there w originally a vague erotic quality—the earliest precursor of the sexu instinct—attaching to all sensations coming from the surface and from t interior of the body, but from birth onwards there are certain spec zones, regions or organs which are specially endowed with this qualit and to each of which there may be said to correspond a particular cor ponent instinct—an instinct, that is, which urges the individual to se the gratification obtainable by appropriate stimulation of that zone organ. Other component instincts are more loosely connected with an tomical regions and are classifiable only on the basis of the peculi activities or feelings connected with them. No psycho-analyst has as y attempted a complete enumeration or classification of the compone instincts.[1] Among the most important are the following :—(1) those co nected with the mouth (the so-called “ oral ” component instincts). observation of any very young baby will show, these are of especial ir portance in the first few months of post-natal existence ; a period whic for this reason, is often called the oral stage ; (2) those connected with t opposite end of the alimentary canal, *i.e.* anus and rectum (the “ anal component instincts) ; these are particularly important in the next sta of development, and it is in regard to them that some of the most sens tional psycho-analytic discoveries have been made ; (3) those connect with the organs and processes of micturition (the “urethral” component (4) those connected with the genital organs proper ; (5) those connect with the activities of vision, which are divided into two main groups—t active or “ scoptophilic,” and the passive or “ exhibitionistic ” ; (those connected with the infliction or endurance of pain—again divid into an active or “ sadistic ” group, and a passive or “ masochistic group.[2] In addition to these, there are certain other components, such those connected with the muscles and the skin, the sense of smell, t auditory sense, which have as yet been insufficiently studied by psych analysts and about which in all probability a good deal still remains to learnt.

In the course of normal development, these various component i stincts become co-ordinated and organised under the leadership of t genital components, so that they ultimately come to serve, at least i directly, the purposes of reproduction. Analysis of normal sexual b haviour can indeed easily reveal the presence of some at least of the components. Thus the erotic excitations connected with seeing and bei seen are among the most familiar of the initial stages of the whole sexu cycle. They play a prominent and essential part in courtship in man ell as in many other of the higher animals, for, wherever vision is the ost important distance receptor, the first intimation of the presence of a ossible mate must be conveyed through the eye. Reference to the kiss is ufficient to recall the general importance which the oral components etain in ordinary sexual life. A certain amount of aggressiveness in the ormal male attitude gives evidence of the rôle of sadism, while female assivity entails a certain element of masochism. Skin and muscle erotism re likewise normally involved to some extent. Perhaps the anal and rethral elements are the only ones to play no obvious part in normal exual life ; and this fact is bound up with two important further aspects f psycho-analytic theory, to which we now pass.

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[1] Freud's *Three Contributions to the Theory of Sex* (1916) is, in its la editions, still the most complete and systematic account.

[2] So named after the Marquis de Sade (1740–1814) and Sacher Masc (1836–1895), well-known individuals whose sexual life was strongly influenc by the component instincts in question.

In the first place the process of organisation of the component instincts, which we have just been referring, goes on simultaneously with the rocess of displacement and sublimation with which we dealt in the last ection. In virtue of sublimation, each component instinct, in the course f its development, transfers a certain amount of its energy to non-exual goals, and upon this process of displacement a good deal both of ocial culture and of individual character depends. It seems probable at, on the whole, the component instincts which can least easily find an dequate place in adult sexuality undergo the most extensive and varied orms of sublimation and displacement ; this is strongly suggested, at any ate, in the case of the anal components, which—as we shall see—while ontributing little to normal adult sexuality itself, exercise a most wide-pread and ramifying influence elsewhere.

In the second place, coincident with the development of the component nstincts with regard to integration, there is development with regard to bject. It has become customary to distinguish three main stages of this tter aspect of development. In the first or *auto-erotic* stage, each in-inct seeks its own satisfaction, more or less as an end in itself. The ero-sm of the very young child must be conceived as being exclusively of this pe, but some degree of auto-erotic activity remains throughout life. ating sweets, smoking, onanism and scratching of the skin are adolescent adult forms of auto-erotism which will naturally occur to the reader. ther activities, such as dancing or gymnastics, which are to some extent pon another plane, contain important auto-erotic elements (in this case iefly of the muscular components), while the anal components, in so r as they are not displaced, tend to remain permanently auto-erotic in aracter.

The second stage is that of *narcissism*. Here there is organisation and rection of love towards a definite object. This object, however, is the lf (hence the name, which is of course taken from the mythical figure of arcissus). The doctrine of narcissism has considerably complicated ycho-analytic theory, inasmuch as it has destroyed the simple outlines the dualistic division of human tendencies into those of self and sex nce much that a facile *a priori* explanation would ascribe to the ego is w seen to contain a libidinal element—a love of self that is in many ys comparable to the love of another individual). Nevertheless the ncept has amply justified itself by the additional insight it has afforded o mental development, the psychology of individual differences and nature of mental disease. We shall return to the subject a little later.

Here, however, we may perhaps remark in passing that narcissism, l auto-erotism, is never entirely outgrown ; some degree of narcissism on the contrary, beyond all doubt, normal and essential. Further to m clear the difference between auto-erotism and narcissism, we may the case of a conflict between the two that is of frequent occurrence at present day. When a woman refrains from indulging in some favou but fattening dish lest she should endanger the slim silhouette tha nowadays so fashionable, a narcissistic impulse (the love of her as possessing the desired-for slimness) triumphs over an au erotic impulse (which prompts her to enjoy the pleasures of table).

The third stage is that of *allo-erotism*, or " object-love," in wh libido is directed outside itself to some external thing or person. earliest manifestations are probably directed to the mother, as soon as child begins to realise her existence as an external person on whom satisfaction intimately depends ; its fullest development is perh reached in the process of " falling in love " which is characteristic adolescence and early adult life.

Development of the Component Instincts

Neglecting these distinctions for a while, let us return to a considera of the development of the component instincts. On the strictly sexual they can be studied in relative purity in those adults who exhibit so-called *perversions* of the sexual instinct. These perversions are co tions in which the hegemony of the genital components has to a gre or lesser extent been replaced by a dominance of one of the o component instincts. Thus the so-called " voyeur " obtains his c sexual satisfaction by looking (so that what is merely preliminary others becomes an end with him), the exhibitionist by being looked the sadist by inflicting pain on his love-object, the masochist by endu pain himself. Freud considers that the young child exhibits the germ all the possible perversions, since there is as yet no genital hegemony indeed little or no libidinal organisation of any kind. That is wha meant when he called the child a " polymorphous pervert." Tho the term may be alarming, the concept is of real utility in affor insight into the essential continuity of the development of hu sexuality.

Let us now consider some of the individual component instincts, special reference to the displacements and sublimations that occur du their development. The oral stage (*i.e.*, as already explained, the stag which the component instinct connected with the mouth is the prominent) has left a deep mark on primitive human culture, a which is to be found even at the present day in such apparently div phenomena as the central rites of religion and the stories of the nur Eating is the most primitive manifestation at once of love and hate. to incorporate by eating is the closest form of communion and lo proximity that is physically possible ; and since the incorporated o is destroyed, it can also be a manifestation of hate (as witness the

at tearing with the teeth is the most natural expression of hostility in
any animals). Hence the oral stage—especially in so far as it relates to
ing rather than to sucking—is exquisitely ambivalent. The rituals of
temism, which constitute perhaps the earliest beginnings of religion,
splay this ambivalence very clearly. A primitive totemic tribe (or more
ictly a certain section of the tribe) venerates a certain species of
imal which it regards at once as a brother and an ancestor. As a rule the
embers of this tribe refrain from eating this animal, but occasionally it
eaten as a sort of ceremony ; and this ceremony is, both psychologically
d culturally, directly continuous with the theophagic communion
vices which distinguish so many of the world's religions,[1] and which in
any cases clearly indicate both love and hate towards the god, who must
killed before he can be eaten. The god, as ancestor and father, some-
nes retaliates by eating his children (as witness Cronos and Moloch),
d when we come to the ancient stories that are still in use in the nursery
oubtless appropriately enough, if there is any truth in the doctrine of
capitulation—a doctrine to which psycho-analysis has given valuable
pport upon the psychological side), we find that they are full of inci-
nts of devouring by animals, ogres, witches or giants.

Scarcely less interesting, though perhaps less well established, is the
luence of oral erotism on individual character. According to the evi-
nce at present available, there would appear to be two fairly well-
arked types of oral character. These types seem to depend upon
ether the history of the individual in the early oral phase of life has
en marked by contentment and confidence (that food will be forth-
ming when required) or by discontent and anxiety. The former leads
a care-free, happy optimism. Like Mr. Micawber, individuals of this
pe always expect something to " turn up," and can thus look forward
pefully to the future, even when there is a shortage of good things in the
esent. They tend to be sociable, uncritical, and open to new ideas.
rsons of the second type are apt to be hurried, impatient and pessi-
stic. They may be always asking, begging or demanding ; or else—in
der to guard against the threat of insufficiency—they may seek a career
t offers safety (*e.g.* through provision of a pension) rather than ad-
ntages or prospects. In some instances they may unconsciously seek to
enge themselves for oral disappointments they have themselves en-
red, as in one remarkable case where a man of this type would invite his
ends to dinner, and then absent himself from home, so that his guests
re turned hungry away. In other cases hostility may express itself
gely through speech, which has here become a displacement of the
re primitive tendency to bite—a displacement, the nature of which is
icated by such common phrases as " incisive argument," " biting
casm " and " mordant wit."

The character qualities connected with anal erotism (*i.e.* the erotism of
component instinct connected with the process of defæcation) are
numerous and varied that they can best be stated in tabular form as
ows :—

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[1] *Cf.* Freud: *Totem and Taboo* (1919). See also the Article on *The Beginnings*
orals and Culture.

Displacements and Sublimations

Retention
  1. Postponement
  2. Defiance
  3. Obstinacy
  4. Miserliness
  5. Love of possessions
  6. Desire to collect
  7. Dislike of waste

Production
  8. Concentration (especially after postponement)
  9. Generosity
  10. Extravagance
  11. Contamination
  12. Untidiness
  13. Noise (music)
  14. Leaving mark } sadistic
  15. Destruction }
  16. Speech
  17. Writing
  18. Painting

Manipulation
  16. Speech
  17. Writing
  18. Painting
  19. Moulding
  20. Cooking
  21. Chemistry
  22. Photography
  23. Building
  24. Engineering

Products
  25. Child
  26. Money
  27. Papers

Reaction-Formations

Orderliness
  28. Tidiness
  29. Organisation
  30. Pedantry
  31. Clear thinkin
  32. Thoroughnes
  33. Punctuality

Cleanliness
  34. Washing
  35. Cleaning
  36. Preventing accumulation
  37. Fear of conta nation (*e.g.* of or " Nature "
  38. " Purity "
  39. Reality

Control
  40. Strong will sisting temp tion)
  41. Asceticism

Those qualities which represent direct displacements of original posi desires are placed in the left hand column, those which correspond rat to " reaction-formations " against these desires, on the right. Hence th in the right hand column often represent opposite characteristics certain of those on the left.

The displacements of the original desires (left hand column) permi being classified under four main heads :—

(1) Those connected with retention of the fæces—an act whic undertaken in the first place (*a*) in order to increase the eventual pleas of the excretory act, (*b*) as one of the ways in which a very young c can show defiance of his nurse or mother. This process soon beco associated with the idea of value attaching to the excreta (" product and hence, by displacement, gives rise to the desire to hoard and ac mulate objects of worth.

(2) Those connected with the pleasure attaching to the excretory

tself. These are of course, in certain respects, necessarily opposite in haracter to those of the previous group. Thus the desire to hoard or etain is contrasted with the desire to give (when associated with love) or vith the desire to contaminate (when associated with hate—though of ourse ambivalence is frequent here).

(3) Those connected with the desire to manipulate the excreta when roduced.

(4) Those corresponding to the simple interest in the excreta as valuble material.

If originally the act of excretion is a matter of pleasure and pride, and ie excreta themselves objects of value and delight, under the influence f parents or nurses this attitude soon changes to one in which excretory cts are regarded as dirty or indecent, acts which must be sternly conolled and regulated. In this way arise the chief reaction-formations, hich for the most part explain themselves.

A few brief remarks may be added concerning one or two of the inividual items of our list.

Nos. 1 and 8 may be found together and manifest themselves alterately in an important type of anal character. The two traits together epresent a displacement of the combined tendency, first to retain, and ien to produce in large quantities. Such persons will, for instance, delay action" (note the word) in important matters until the last possible ioment, and may then become feverishly energetic and perform proigies of work in a short time ; or else they may refuse, for instance, to iswer correspondence or pay their bills, until there is a great accumulaon of arrears, to which they will then, however, devote themselves with erce attention. Nos. 4, 5, 6, and 7 are, of course, usually found in comnation with No. 26, which last is perhaps culturally the most important iblimation of anal erotism. Indeed there can be little doubt that a great eal of the economic basis of our present civilisation is supplied by this rm of displacement. Nos. 14 and 15 represent tendencies the strength which can be gauged by the difficulty encountered by the recent moveent to preserve our parks and countryside from dirt and litter. The nnection of these tendencies with anal erotism should be clear to anye who will take the trouble to study the inscriptions to be found in most any public lavatory. No. 25, which may at first seem strange, is e to the infantile theory of anal birth, a theory which is very natural in ew of the child's ignorance concerning the functions, or even the prence, of the vagina.[1]

The known effects of urethral erotism, *i.e.* the erotism connected with e passing of urine, are far less varied and extensive. There is a certain iount of evidence to show that a highly developed interest in this pross may be connected, at any rate in men, with the character-quality of ibitiousness. In its gradual displacements, the interest in question may d to preoccupation with pipes and water, and thence to plumbing, draulic and electrical engineering (the latter owing to the unconscious equation of fire and water). But water in some form or other usually re tains its attraction. Thus of the two cases of unusually marked urethra erotism which the present writer has himself had the opportunity o studying, one was a sailor, the other a keen swimmer.

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[1] It is very difficult to do justice to the complications of anal erotism in a few rds. The student who desires a fuller treatment of the discoveries of psychoilysis in this field should consult the relevant chapter in Ernest Jones' *pers on Psycho-Analysis*, 3rd edition (1923).

Both sadism and masochism normally retain some importance in th actual sexual life ; to some small extent they must be regarded as con stituents of normal love. Furthermore, in most people they remain po tentially active throughout life, so that by appropriate stimulation the can easily be aroused in an intensity that borders on the " perverse " witness for instance the almost universal sexual attraction that is exercise by tortures and other " horrors." When such a perversion succeeds i escaping from control, it can of course become extremely dangerous, an may even manifest itself in " lust murders," such as those of " Jack th Ripper." It is frequently allied in a subtle way with anal erotism, and ma then give rise to the actual practice of the phantasy of whipping. Ther are certain walks of life which would appear to offer good opportunitie for the satisfactory sublimation of even high degrees of sadism—such a the professions of butcher and of surgeon. A more moderate degree o sadism can be utilised in many kinds of work ; but there are other pro fessions where everything much in excess of the ordinary degree is sociall dangerous, however satisfying to the individual himself—such profession as those of judge, magistrate, policeman or teacher. And these example serve to remind us of certain very important aspects of sadism o masochism that have come to light in recent years.

We have already indicated how the mind possesses the power of arrivin at a compromise between the forces of instinct and those of inhibition This compromise is especially characteristic of neurosis, but is found als in conditions that would not ordinarily be called neurotic. In the example that we have hitherto studied there takes place a condensation or over determination which expresses both of two conflicting wishes. A slightl different form of compromise is one in which the inhibiting tendencie organised within the Super-Ego (*cf*. p. 359)—powerless to achieve a com plete repression of the instinctive desires—permit some satisfaction o the instincts on condition that there be endured a certain amount of pai or suffering, as though by way of punishment to compensate the pleasure Now the sadistic or masochistic impulses are peculiarly suited to ente into a compromise of this sort, for they can obtain their satisfaction b the very means adopted by the Super-Ego in exacting punishment. Henc it is justifiable to speak of a special class of " moral sadism " and " mora masochism." In moral sadism the impulses are directed outwards, an obtain gratification from punishing others who have allowed themselve certain forms of forbidden satisfaction. Our legal and punitive system and our own social codes are full of instances in which society as a whole or certain members of it, gratify at once their sadism and their mora indignation by punishment (often cruel enough, for most tortures—bot of body and of mind—have been justified on moral grounds) of thos who have offended against our legal, social or ethical codes. The same wa true till fairly recently of our religious and educational systems. Now fortunately, civilised humanity has achieved the great step of abolishin religious intolerance (though the abolition of political intolerance—i ome ways its modern equivalent—is proving hard to accomplish), while ie moral-sadistic features of education are also tending to disappear. In ıoral masochism the impulses demanding pain and punishment are ırned against the self, and may give rise to all sorts of discomforts, ilures, self-deprivations and self-humiliations, the nature and extent of hich psycho-analysts have only just begun to realise. The sexual element these latter cases is often less easily revealed to superficial investigaon. Nevertheless, it is commonly recognised that there exists a class of ersons who " enjoy " their own sufferings, of which they will not readily ermit themselves to be deprived. Such persons represent (within the nge of the normal) extreme cases of moral masochism. We may suggest deed that there are certain times and certain cultures which have been ecially favourable to (or perhaps we should say, dominated by) such rms of self-punishment, *e.g.* the Middle Ages with their monkish and cetic traditions, and to the modern civilisation of the Slavs.

The development of the somewhat analogous pair of component inincts known as scoptophilia and exhibitionism presents on the whole somewhat simpler picture. A strongly developed scoptophilia may give se to a generalised curiosity and love of spying and prying into others' ves or secrets ; on the lower levels of displacement, the sexual backound is often still discernible, and in the common forms of gossip, to hich so many of us are prone, displaced scoptophilic tendencies will ten fuse with moral sadism of the kind that we have just been discussg. In the higher forms of sublimation, scoptophilia would seem to play most important rôle in scientific investigation, though even here some ement of sadism may often co-operate. The scientific man " loves " s " subject," but nevertheless betrays a certain aggressiveness towards as he " wrests " or " wrings " its secrets from it.

The exhibitionistic instinct originally relates to the naked body, but the course of individual development it inevitably (in civilised races) comes displaced, to a greater or lesser extent, on to clothes. Clothes are, wever, exquisitely ambivalent, inasmuch as they both cover the body d thus subserve the inhibiting tendencies that we call " modesty," and the same time afford a new and highly efficient means of gratifying hibitionism on a new level ; as a successful compromise-formation they ford an interesting social parallel to many forms of individual neuroses.[1] its simpler manifestations, as still attaching to the naked body, exhibinism is often reinforced by skin and muscle erotisms, and these three mbined play a large part both in sport and in the gymnosophist nudist ") movements of to-day. How strong and fundamental is this sire for nakedness, which we have retained in the unconscious from r childhood, is shown in the fact that one of the most general and typical dreams reveals to us ourselves as embarrassingly nude or underclothed public. In its more sublimated developments, scoptophilia may lead to adoption of professions which involve playing a prominent and public e, such as those of the stage, the screen, the bar and the pulpit ; while,

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The present writer has elsewhere endeavoured to trace in detail these herto somewhat neglected psychological aspects of dress. See *The Psychology Clothes* (1930).

in its pathological aspects, it would seem to have a connection (at present but little understood) with certain skin diseases.

Turning lastly to the component instincts connected with the genita organs themselves, there seems little limit to the numbers of life’s activities which receive at least some impetus from displaced genital libido—as is shown by the immense number of sexual (especially phallic) symbol connected with all kinds of objects and pursuits.

Two of man’s great cultural achievements, however, stand out perhap above all others as having derived the necessary energy from this sourc —the making of fire and the discovery and development of agricultur We have already referred to the connection of fire and heat with sexuality and, as to agriculture, we may remind the reader that the word “ plough is used in many languages to denote the sexual act, and that such term as “ seed,” “ fertility,” and “ barrenness ” are applied indiscriminatel to vegetation and to human beings. The widespread tendency to accompany agricultural ceremonies with sexual rites and sexual orgies agai affords an anthropological corroboration of psycho-analytic findings. T mention just two other examples of genital sublimation, another, perhap even more fundamental, instance is the use of tools, which are amon the commonest of sexual symbols ; while certain prominent philologist consider that the development of speech owes much to the deflection o sexual energy to this sphere, a contention to which psycho-analysts i their turn have brought considerable supporting evidence.

One further phenomenon connected with the genital instincts must b mentioned, because of its widespread influence and great importance This is not (as in the other cases we have mentioned) a displacement o desire, but a reaction-formation, in the shape of anxiety lest the genita organs or their functions be harmed or interfered with. Arising in th first place, it would appear, as a fear of talion punishment for sexua thoughts or acts which have come to be regarded as guilty, this anxiet exerts a great influence in the unconscious minds of many individuals where it constitutes what is usually called the “ castration complex. In its typical form it is a male phenomenon, and attaches primarily to th feared loss of the phallus ; but it may also occur in women, in whose cas it leads to the belief that the phallus has been lost (and thence to seriou feelings of inferiority). Indeed the anatomical differences between th sexes often play an important part in the origin of the complex. Normally, however, the ability to produce a baby seems to be the female psychological equivalent of the male’s possession of the phallus. This is perhap connected with the fact that the castration complex proper (as applyin to the genitals) appears to be only a particular aspect of a general fear o loss of the means of satisfaction—a fear which is often connected wit a whole series of earlier “ traumatic,” or shock-producing, situations, i which loss of the mother’s womb (at birth), loss of the breast and loss o fæces all play a part. The precise significance of these last mentione connections is not yet fully understood, but of the existence of the connections there can be no reasonable doubt. Finally we may mention tha the castration complex appears to have a good deal to do with the development of phallic symbolism, since the use of objects which possess th requisite symbolic significance (often rationalised as means of protectio ainst " ill-luck " or the " evil eye ") affords reassurance against the ared loss of the valued organ.

arcissism and the Super-Ego

Let us now leave the individual component instincts to consider very iefly the more general development, through the stage of narcissism, that of allo-erotism. In narcissism, as we have stated, the libido is ected to the self rather than to the outer world. Strongly narcissistic lividuals can be recognised by their preoccupation with their own dies and (at a somewhat more extreme stage) with their own minds. very high degree of such narcissistic preoccupation makes the person question relatively uninterested in, and independent of, the outer rld; hence prevents the formation of the *rapport* or transference that essential to all psycho-therapy. All forms of insanity imply some degree withdrawal from the outer world. Perhaps the strongest impression at is received by any person visiting an asylum for the first time is one surprise at the very little interest that the patients take in one another. ch seems immersed in his own concerns; there are no groups of two three gossiping together, as there would be in a similar collection of rmal people. In so far as the environment is taken into account at all, tends to be reconstructed from within upon a delusional basis. Such rsons have permanently lost their hold upon reality. All of us however ve periodical relapses from contact with reality—in an extreme degree ring sleep, and in a lesser degree during day-dreams and phantasy. In antasy we achieve an imaginary fulfilment of our desires without the uble of taking the necessary steps to achieve them in reality; in Freud's minology, we are thinking according to the " Pleasure Principle " and according to the " Reality Principle." This does not mean, however, t phantasy is necessarily useless. On the contrary it is probably ential :—(1) as an outlet or " safety valve " for desires that must intably remain unsatisfied in this imperfect world, (2) as a preliminary p towards actual achievement, for the fore-pleasures of imagination y act as a bait destined to lead us to the more toilsome, but more pernently satisfying, enjoyment of reality. It is only when phantasy withws an unnecessary quantity of energy from our dealings with the outer rld, that it can be regarded as pathological; the diseases of phantasy indeed only in the nature of misuse of that all-important faculty that n possesses for " looking before and after."

part from abnormal conditions, the nature of narcissism can perhaps t be realised by drawing certain comparisons. Let us compare first the ntal states in bodily health and bodily disease. In the latter condition rest inevitably becomes more concentrated on the self; an ill man kes a poor lover. The difference in question is most strikingly illused by temporary troubles that appear and disappear very quickly, such oothache or sea-sickness. In both states the sensations from our own y are so absorbing that they compel the withdrawing of our attention n from persons and things that were full of interest but a little while ore.

s a second comparison, take the two sexes. Our present society expects encourages a greater amount of narcissism in women than in men.

In women we cheerfully tolerate a degree of preoccupation with person appearance that we should regard as foppish and effeminate (note t implication) in a man. In men's dress the note of display (for narcissis in its social aspects, naturally exploits exhibitionism) is sternly suppresse Even in the actual love-life itself there is a difference : a woman seeks be loved rather than herself to love, but a characteristically allo-ero man wants actively to possess himself of the loved object, and is som what indifferent as to whether he is loved in return. Of course the diffe ences are in any case only relative ones. Men may also find certain su stitutes for the personal beauty which is the goal of the narcissistic libi in women. Athletic prowess and muscular development may be such substitute (a well-known exponent of physical culture tells his pup that they will find their exercises " more interesting if performed befo a mirror "). Intellectual prowess may also serve as a more subtle a sublimated substitute in both sexes, and this leads us naturally to t higher and more complicated developments of narcissism.

The earlier and more primitive forms of narcissism consist of love oneself as one actually is. A larger or smaller amount of libido remains this level throughout life. But, in the course of further development, certain quantity of the libido originally entering into this form of na cissism undergoes displacement—and this in two main directions. the one hand there is a displacement from love of self to love of othe *i.e.* a passage from the stage of narcissism to that of allo-erotism. this we shall return in a moment. On the other hand there is displaceme from love of oneself as one actually is (the real self) to love of oneself one would like to be (the ideal self, Ego Ideal or Super-Ego—the sa Super-Ego which, as we saw earlier, plays such an important part in t moral constitution of man). This displacement of primitive narcissis on to an ideal constitutes one great source of the energy whence o (often so fierce and overpowering) morality is derived. Another gre source is more complicated in its origin. It comes from an introjecti into the self of the earliest external moral forces, *i.e.* the moral attitu and precepts of parents, nurses and other influential persons from who the child first learns the distinction between right and wrong. By mea of this introjection (or internalising) the individual comes in time, as were, to carry in himself, as part of his permanent mental equipment, t moral standards of his environment. What were originally external san tions have become internal sanctions. Recent studies in child analy have shown that the foundations of the Super-Ego are laid at a very ea age (certainly before five), and this to some extent explains the peculia archaic and inaccessible character of these foundations—which can influenced only with great difficulty by subsequent experience. It owing to this inaccessibility that man is, in Freud's already quot words, " far more moral than he has any idea of," and that there are oft (perhaps always) serious inconsistencies between the, generally mo lenient, adaptable and " reasonable," morality of consciousness and t sterner and more inflexible moral elements in the unconscious—inco sistencies that are perhaps particularly striking in present-day individu of advanced views whose theories are often far more liberal than th practice.

So stern and uncompromising is the Super-Ego that, though it un-
ubtedly depends to a large extent upon the introjection of the morality
our elders, it would nevertheless seem that there must be further
ctors at work in its formation, especially since there is by no means
ways an exact correspondence between the severity of the Super-Ego
d the actual sternness of the parents. This is one of the great problems
th which psycho-analytic research is grappling at the present moment.
ır knowledge is not yet advanced enough to state anything with cer-
nty, but it appears as though at least one important factor lay in the
coil upon the self of the individual's own aggressive tendencies. These
ndencies are called up by any frustration of desire, and are at first
ected outwards. We act as though all frustration were due to an inten-
nal hostility on the part of those about us (much as the savage still
nks that ill-luck, disease and death are all due to black magic or to
stile spirits). But, since we both love and fear our elders, this aggres-
ity due to frustration must be itself inhibited, and thus frustrated;
d it would seem that all inhibited aggressivity must either find another
tlet (through displacement—as when the clerk, who has been angered
his employer, vents his wrath upon the office-boy), or else be directed
wards against the self. In very early life alternative external outlets are
ficult to find; the aggression therefore returns upon the self and con-
tutes one of the chief sources of the savage and cruel aspects of the
per-Ego.

In so far as this theory is true, we can see how even exceptionally mild
d indulgent parents may yet be instrumental in forming a stern Super-
o in their children, for such parents are peculiarly unsuited as objects
which to direct a fierce aggression; hence the greater necessity of
ibiting this aggression and its consequent greater likelihood of turn-
back upon the self. We can see too that the problem of an over-
rn Super-Ego is not necessarily solved by the mere substitution of kind-
s for severity in the nursery and in the schoolroom. The problem
more difficult than that. Possibly the solution may lie in a com-
ed method of diminishing frustration (by a more tolerant attitude to-
rds the "polymorphous perversion" of the child—an attitude which
uld be the nursery equivalent of a greater social leniency towards the
uality of adult life), combined with the provision—where possible—of
able outlets for such aggressivity as is still inevitably aroused. This is
et little more than speculation, but it is clear that the problem is one
h which the further development of psycho-analysis will soon bring
ace to face.

et us now return to more established aspects of psycho-analytic
ory. The nature and function of the Super-Ego, as conceived by
lysts, cannot be fully understood without a reference to certain further
cepts elaborated by Freud in his book *The Ego and the Id*, published
923. Here the mind is divided into three parts, termed the *Ego*, the
er Ego and the *Id*. The Ego is that part which is concerned with the
ception of outer reality and our adjustment to it, while the Id is the
t reservoir of instinctive energies from which all our desires are
nately derived, but for which we do not always consciously hold our-
es responsible (hence the term [the "it"], which indicates that we

tend to regard it as something foreign to our *selves*, as when we say, “
was carried away by my emotions,” or “I was overcome,” by them). T
Ego has a hard task, calling for much strength, skill and diplomacy, in
much as it has to do its best to satisfy three masters, to wit, outer reali
our instinctive desires located in the Id, and our moral standards locat
in the Super-Ego. In mental disorders, the Ego has proved unequal
this task (though the actual nature of its breakdown varies with the natu
of the disorder), and the aim of psycho-analytic therapy is to strength
the position of the Ego. This involves : (1) an uncovering of the Id,
that the true nature of the (repressed) instinctive desires is revealed, (2
no less free examination of the nature and demands of the Super-Ego, a
(3) a breaking down of such neurotic compromise functions as have be
arrived at between the Super-Ego and the Id. Both Super-Ego and
have therefore equally to face reality, and to make the sacrifices that m
be necessary in order that the human energies locked up in the conflict m
find a free expression in reality, *i.e.* in order that our desires may rece
the maximum of “real” gratification in a way that is in harmony with
claims of rational or enlightened morality. The essential difficulties,
we are beginning to realise, lie in (2) and (3) rather than in (1). As
gards (2), it may be safely said that every successful resolution o
neurosis involves some modification and relaxation of the claims of
Super-Ego, which is often just as unwilling to take account of the realit
of human nature (*i.e.* the fundamental and ineradicable nature of the
stinctive urges), as the Id itself is unwilling to take account of the
stacles that the outer world so often puts in the way of our desires. Ab
all, it must give up certain archaic features of its constitution, such as
(*a*) the tendency to punish thoughts with the same severity as actions
when a person treats himself as though he were actually guilty of
death of a relative, whose death he may unconsciously have desired,
which he has done nothing whatsoever to bring about), (*b*) the tende
to extend the condemnation of a specific desire to all desires remot
associated therewith (*e.g.* to condemn all sexuality because the first
pressions of infantile-sexuality had an incestuous foundation). But p
haps the biggest difficulties lie in (3). A neurosis of long standing rep
sents a peculiarly stable compound of the forces of the Id and of
Super-Ego, which is hard to break up because both sides fear to lose
a resolution of the compromise. To use a social parallel, the satisfact
which the Super-Ego and the Id derive from the neurotic symptom
like that which the Churches and the bootleggers alike find in Prohi
tion, and which renders both sides equally unwilling to consider obj
tively the possible benefits of a repeal of this restriction upon liberty.

It is a curious and interesting fact that, so far as psycho-analytic
vestigation has yet gone in the study of the Super-Ego, it seems to sh
that our troubles—both individual and social—are due much more
the excessive, than to the deficient, morality of man. In fact, no sin
analyst has as yet reported a case in which the Super-Ego of his pati
seemed dangerously weak. This somewhat paradoxical finding is larg
due to the fact that an excessive development of the Super-Ego, w
consequent extreme efforts at repression, prevents the displaceme
and sublimations of the libido that accompany “normal” developme

e libido therefore remains fixated at a relatively crude and infantile el, and in a sense, therefore, really tends to express itself in actions t would be regarded as improper or immoral if judged by adult ndards. A vicious circle is thus set up ; repression induces fixation, l this in turn gives rise to fresh efforts at repression. The only cure for h a condition is a relaxation, and not a tightening, of the moral cenship. Indeed, many anti-social acts, which might at first seem to inate an unduly feeble Super-Ego, are clearly traceable upon closer exination to the influence of the Super-Ego itself. Among such acts are : the " crimes from conscience," to which, as psycho-analysis has wn, certain persons may be driven, in order that the consequent iishment by society may replace and alleviate the intolerable tension of ernal guilt ; (*b*) the deeds of hostility and revenge prompted by the vitable resentment occasioned by a too deep and constant frustration vital instincts ; (*c*) the direct expressions of libidinous tendencies that permitted on condition that they are paid for in terms of suffering ; the cruelties that result from a projection on to others (" scapegoats ") this need for punishment. This last case, as already mentioned in ther connection, usually exhibits a strong admixture of sadistic nds. It undoubtedly constitutes a source of aggression of a socially y disruptive kind, into the amazing strength of which we are only just uiring a dim insight.

ect Love

eaving this difficult and comparatively recent chapter of psycholytic theory, let us in conclusion deal briefly with the third stage of elopment—that of object love or allo-erotism. Freud has drawn a short scheme of the chief means of transition to object love, which erhaps worthy of quotation here. According to this scheme there are chief ways of acquiring a love object :

cissistic Type, in which love is irected to :	1. What one is. 2. What one was. 3. A part of oneself. 4. What one would like to be.
clitic Type, in which love is irected to :	5. The mother who nourishes. 6. The father who protects.

he first four cases the transition to object love is *via* narcissism. The n " anaclitic " (literally " leaning up against ") means that in the first se of their existence the outwardly directed elements of the libido themselves, as it were, upon the self-preservative instincts and thus ome directed to the persons who satisfy the latter instincts.

o. 1 is the simplest form of object choice. It represents a simple disement of primitive self-love (love of the " real " ego) to love of others, rding to the principle of similarity. Thus, quite generally, we tend ve those who are like ourselves, whether the resemblance be one of lect, character, moral standard, social class, racial type or physical acteristics (as when, for instance, as statistics indicate is on the whole

the case, tall men marry tall women, and vice versa). One particula
important aspect of this type of choice is that which leads to homose
ality, for a person of one's own sex is in certain important respects m
like oneself than is a person of the opposite sex. Connected with thi
the fact that a homosexual object-choice is very frequently found
association with a strong element of narcissism ; heterosexuality see
to demand on the whole a further general advance of the libido in
direction of allo-erotism than does homosexuality.

No. 2 depends upon the fact that the narcissistic libido often und
goes a fixation at a certain stage of the development of the individ
concerned, usually the stage at which he (or she) still possessed
physical charm of youth and beauty. Such an individual then rema
permanently in love with himself, as he was at the particular age c
cerned (a fixation which indeed seems sometimes actually to prolong
youthful appearance of the individual). When fixated narcissism of
kind is displaced on to another person, it chooses as object a person
sembling the lover as he was at the age at which the fixation took pl
It may thus give rise to pæderasty. But it may also operate in a more sul
manner, as when a woman sees in a young man just those element
" boyishness " which she herself has inevitably lost to some exten
puberty, when she acquired the special characteristics of her own s

No. 3 is the special form of narcissistic object love that character
the love of parents for their children, who may be regarded as con
tuting (almost literally—especially in the case of the mother) a part
themselves. It is in virtue of a displacement of this type that a
narcissistic woman may become a loving mother, even though she
have shown herself capable of but little affection towards her husb
(who is unable to attract the narcissistic libido in this way). Parental l
however, seems only to be the extreme case of a very general tendenc
regard everything on which we have lavished toil and care as, in a
tain sense, an extension of our own personality. The attitude of the
lector to his treasures, of the inventor to his invention, of the write
his book will naturally occur to the reader in this connection. Indeed
labour of an author in producing his work has often been compare
that of a mother in giving birth to her child.

If No. 1 corresponds to the displacement of that portion of the nar
sistic libido which attaches to the " real ego," No. 4 represents the
placement of that portion which attaches to the Super-Ego. It is
element which, beyond all others, accounts for the (as it so often seem
others) absurd over-estimation of the loved object by the lover, who o
considers himself all too unworthy as compared with the virtues of
person on whom his adoration falls (just as his real ego is " unwortl
as judged by the standards of the Super-Ego). In its more specific w
ings, this type of object love may lead to the choice of an object
possesses different or opposite qualities to those of the lover, the lo
person thus representing a " compensation " for just those qualitie
which the lover himself is deficient (corresponding to a projected f
of that compensation for " organ inferiority " which Adler has emp
sised in dealing with the individual). This type of love may there
exhibit opposite characteristics to those of No. 1.

Types 5 and 6 are more generally understood outside the ranks of
cho-analysts themselves, and therefore may be dealt with very shortly;
, ever since the early days of psycho-analysis, the Œdipus Complex
occupied the foremost place in all discussions of the subject.[1] It must
fice here to remind the reader that one of Freud's most fundamental
coveries concerned the vastly important rôle of the father and mother
the earliest objects both of love and hate. The myth of Œdipus, who
s his father and marries his mother, represents the translation into
lt terms of the primitive tendencies of the boy child who has realised
t his father is a rival who prevents his own (the child's) monopolisa-
1 of the mother's time and love. A similar attitude *mutatis mutandis*
characteristic of the little girl, though in her case the development is
her more complicated, inasmuch as her very first love-object is the
ther, just as in the case of the boy. Indeed, in the case of both boy and
, the attitude toward both parents is to some extent an ambivalent
, though in normal development love goes preponderatingly towards
parent of the opposite, hate to the parent of the same sex as the child.
all possible combinations of love and hate are to be found, from the
y developed "normal" to the "inverted" Œdipus Complex. In this
er form of the complex, the boy (usually as a means of avoiding the
erwise inevitable hostility with the father) identifies himself with the
ther and seeks to love the father in her place, so that she, rather than
becomes the rival—the girl of course behaving correspondingly. This
erted Œdipus Complex is another important factor in the production
homosexual object-choice.

he original love and hate embodied in the Œdipus Complex under-
s extensive and important repression and consequent modification
displacement. Hate is often to a great extent repressed and con-
ed by love, though it may throughout life influence character through
ous unrecognised displacements. Love itself undergoes repression
ugh the very strong taboo of incest, which is one of the most re-
kable features of human society at all levels of development, and the
ence of which can be traced in the various exogamic rules and prac-
s which distinguish so many primitive peoples. As a result of this re-
sion there is brought about a certain dissociation between the sensual
ents of love upon the one hand and the elements of tenderness, devo-
and respect upon the other—a dissociation which is of the greatest
ortance for both social and sexual life (especially in the male sex), but
he true nature and causes of which we are still far from having a
plete knowledge.

nly second in importance to the child's attitude towards his parents is
attitude towards his brothers and sisters. Here too there is a general
sal of ambivalent emotions. A younger brother or sister is often at
looked upon as a rival, though (especially if there be some con-
rable difference in age) quasi-parental feelings of love may also be
ndered. These feelings of love are in their turn subject to repres-
at the hands of an incest taboo which is but little less severe than
operative between parents and children.

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full treatment of the theme in all its ramifications has been attempted
e present writer in his *Psycho-analytic Study of the Family* (1921).

A great deal, both of individual character and social culture, depe upon the gradual displacement of the various loves and hates arou within the circle of the family. Here we can only indicate in ba enumeration some of the most important forms of this displacement

A strong parent fixation in persons of either sex may manifest itsel an inability to marry or leave home, or a failure to achieve reasonable s reliance and independence of character. The actual displacement parent-regarding feelings may take place along lines of relationship (from father or mother to brother or sister, uncle or aunt, cousin, e age, name, character, general situation, etc., *i.e.* any one of these fac may act as the mediating association of a displacement. A particul important instance of the last mentioned type occurs when a repeti of the original Œdipus situation, in which there was an obstacle to child's love, is sought as an essential condition of later loves. In s cases, a love without external impediments is unattractive and a perso capable of sexual attachments only to, say, engaged or married ind duals of the opposite sex. So frequently is this tendency present in s degree or other that it seems to form the ground of the very widesp appeal of the " triangular situation " in literature and the drama.

In successful " normal " development there takes place a gra " weaning " from the parents and the parental situation, so that ultima the individual is free to live and love in ways that have but little refer to the original family situation. Entire freedom is, however, in all pr bility impossible to achieve, for analysis can nearly always reveal s association with the parents, who were the original objects of love, and hatred. Thus, in our attitude towards social groups and instituti the same influences are operative as in the case of our attitude to i viduals. The individual's love for his country is largely tinged b association with his father or mother (" Motherland " or " Fatherlan as is also his love for his native town, his school, his church (" Mo Church "), his University (" Alma Mater "), and even his " mo tongue." The enemies of his country are treated as though they would-be ravishers of his mother, while to those who hold positio authority within his own group he displays the same ambivalent e tions of love and hate, of veneration and impotent rage, that he once towards his father. Politics indeed represent little more than a reli and re-enactment of the infantile attitudes aroused in connection wit Œdipus Complex, and, until this is understood, there is small ho human conduct in this field becoming more rational and more adjust reality.[1]

A few final words on certain further effects of fixation at the Œd level must bring this Article to a close. When the fixation on the pa is strong, the child may be unwilling to abandon the exalted idea th has formed of the power, knowledge and goodness of the parents real parents, when he comes to understand that they also have deficiencies and limitations, are very disappointing when compared the magnificent beings that he had imagined them to be. This may rise to the very widespread " foster-child phantasy," according to w the child himself is a changeling, who has lost his true parents and opted by others, who are inferior to them in wealth, station, character or wer ; a phantasy which has found expression throughout the ages in he myth of the birth of the hero," in which the young hero, the son of ds, princes or nobles, is brought up by animals or peasants. Moses, rseus, Romulus, Lohengrin, are a few among the very many legendary roes of this type, while Mowgli and Tarzan of the Apes represent corponding figures from modern literature.

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[1] *Cf.* Pryns Hopkins: *Father or Sons* (1927).

But the most general of all methods of dealing with this persistent ging for the ideal parent is to project him into the heavens as a deity ; gods and goddesses are the omnipotent parents of our infancy, pernently enthroned in their high estate. By this act of projection the ılt human being saves himself the painful realisation of the fact that he ultimately dependent on his own efforts, and is enabled to retain the antile notion—to which we would fain all regress in time of trouble— t there is somewhere a watchful and loving parent who is ever solicitous our welfare. But the gods can be angry as well as kind, and this aspect deity corresponds to the hostile and (especially in the higher religions) he moral aspects of the parents. God, as judge or avenger, fulfils much same functions as the Super-Ego, and may be described as the exnal equivalent of the Super-Ego. The punishments, sacrifices and etic practices demanded by God are similar, in their general intent, to se demanded by the Super-Ego, and are inspired by much the same ling of guilt.[1] How strong is this feeling, and the consequent need for avenging God, is shown, for instance, by the inability of organised ristianity to remain contented with the more purely positive and loving rality of its founder. The attitude implied by Christ's words, " Neither I condemn thee," leaves unsatisfied the " need for punishment," ch is as important a feature of religion as it is of neurosis. Christ's tude demands a freedom from guilt and hatred, which only a very few t minds here and there have been able to achieve, and the attainment vhich on a large scale is possible, if at all, only by a general understand- of the neurotic and quasi-neurotic elements of guilt, which psycholysis alone would seem to be in a position to bring about. As long as e is serious fixation at the level of the infantile attitude towards the ents, it would seem almost inevitable that there should be, not only endence on the parent substitutes (which merely makes us helpless and rogressive), but also hate towards them (which makes us cruel as well). t the attitude of humanity towards its gods is deeply ambivalent can hown by any thoroughgoing analysis of religious belief and ritual, but cially by an analysis of sacrifice, which has as its ultimate motive the ing of the god himself, and is thus a repetition of the prototype of all t crimes—parricide. A religious or social attitude based consistently ove would seem to be possible only in so far as the hatred, and conently the guilt, associated with our infantile reactions to the parents, been generally outgrown.

e have finished our survey of psycho-analytic theory. This theory is dy so complex and has a bearing on so many fields, that much has ssarily been left unsaid, and much has had to be presented in a condensed and somewhat dogmatic fashion. But it is to be hoped that have at least made clear the great importance and interest of the subje If, in conclusion, it be asked, what is the bearing of psycho-analysis human culture as a whole, the answer would seem to be, that it holds c the promise of enabling us to become more conscious of ourselves, a thus to extend our powers of rational insight and control. The biologi value of conscious mind lies in its capacity for delicate discriminati and adaptation. The unconscious instincts and reflexes by which c lives, like those of other animals, are so largely determined, doubtl have great value for rough orientation towards our environment. E they tend to work on the “ all or none ” pattern, and are incapable those finer adjustments of means to ends, which, when organised a co-ordinated in physical science, have enabled man to win an altogetl unique power over Nature. But this power is itself a danger unless i accompanied by a corresponding knowledge and control of our o selves ; which alone will enable us to use this power for beneficial, ratl than for harmful and self-destructive, ends. The psychological and soc sciences are, it is universally admitted, in a lamentably backward state compared with those other sciences which deal with our physical vironment. In psycho-analysis man would seem to have an instrum with which to readjust this balance, and thus to become master in his o house, as well as in the outer world.

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[1] *Cf.* R. Money-Kyrle : *The Meaning of Sacrifice* (1930).

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THE BEGINNINGS OF MORALS AND CULTURE: AN INTRODUCTION TO SOCIAL ANTHROPOLOGY

By

R. R. MARETT

SYNOPSIS

thropology, the science of Man, divides into Physical and Cultural nches that are severally concerned with body and mind ; and of latter, while other sub-divisions deal with handiwork and lan- ge, the most important section is Social Anthropology, namely, the dy of moral institutions and ideas. As for method, any enquiry the historical development of morality must start from the tincts ; must thence go on to observe how reason supervenes on tinct to lend conscious direction to the process ; and, finally, must w by reference to the facts how conduct conforms to the change of trol involved in this substitution of intelligence for blind impulse. w the instincts, though the biological function of all alike is to mote the survival of the species, fall into two main classes, accord- as they either directly subserve group-maintenance by way of ting, nursing, and herding, or indirectly do so by enabling the ividual to achieve self-maintenance through self-protection, self- rtion and self-sustenance. When man's instinctive endowment is s analysed it turns out that, as compared with other animals, he ws no deficiency in this respect, but on the contrary has so many hese predetermined tendencies that in practice they would con- and hold one another up, were it not that the resulting instability rds intelligence the chance of bringing experimentation and choice bear on this wealth of possibilities. At the primitive stage of ety, however, intelligence has but shaken off the tyranny of instinct succumb to that of habit. Morality is of the customary type. ernally viewed, it depends on a law, religion and education that st on rigid conformity to convention, a sort of tribal drill. In its rnal aspect, again, the moral judgment involved is uncritical, science amounting to a mere orthodoxy, and even the leaders of nion depending rather on subconscious inspiration than on ction. A review of the actual moral codes of savages illustrates dependence on ready-made standards of right and wrong. As

the instincts can be distinguished as group-maintaining or se
maintaining, so the moral activities can be classified as making eit
for sociality or for personality. Under the first head come domes
tribal, and inter-tribal forms of organization regarded as attempts
establish closer and wider relations between human beings natura
associated by blood or by local contiguity. A one-sided family
and narrow clannishness gradually evolve into a more or less we
disciplined tribalism capable of certain courtesies towards strange
But savage society gets no further than this, imposing as it does
uniform and fixed a set of rules on its members to provide scope
the variability and initiative on which the possibility of a hig
culture rests. Under the second head, however, fall agencies t
help to build up a moral personality of a rudimentary type, so t
both manliness and godliness come to serve as ideals on which
individual may model his life. Such manliness is pictured chiefly
the power of cutting a brave figure in society. The godliness, on
other hand, is more clearly conceived as a state of the soul;
primitive religion is more successful in prescribing negative obli
tions in the form of abstinences than in enjoining a positive sche
of good behaviour. Even so, though it does little to clarify morals
greatly helps to heighten morale.

THE BEGINNINGS OF MORALS AND CULTURE: AN INTRODUCTION TO SOCIAL ANTHROPOLOGY

INTRODUCTORY

Adjacent Fields of Research

ll distinctions are drawn at a venture, and even the distinction be- een Physical and Cultural Anthropology—in other words, between an's body and his mind, together with the things into which he has put mind—is not quite so radical as might be supposed. It is not a question erely of those cultural adornments that become more or less permanently ached to the body, such as the tattoo-marks of a savage or the civi- ed man's false teeth. In so far as our bodies take outwardly or inwardly impress of our habits, or, in biological language, in so far as concerns quired as opposed to inherited characters, the anthropologist of the dy has to consult his colleague, the anthropologist of mind and society ; d in practice, whatever may be the case in theory, it is hard to prevent overlap between the two kinds of work.

Next comes another set of distinctions, also difficult to determine ex- ly, that fall within the sphere of Cultural Anthropology and enable it be broken up into sections employing each its own appropriate thods, and its own body of special students. Thus Technology, which ls with the products of the human arts and crafts, whether useful or orative in their intention—in a word, with what is known as Material lture—forms one group of studies. A second comprises Linguistics, ich examines the various speech-forms of Man considered apart from ir literary outcome ; the latter topic being treated as the affair of the rd group. This remaining section, by far the most comprehensive of three, is known as Social Anthropology. It is with it alone that we e to do here.

Before proceeding to consider it in detail, however, two further points ut classification must be noted. The first is that General Anthropology, t may be called, embraces all the topics already mentioned. So far as it s to use their several results in combination—as notably when it s to account for the Distribution of Peoples in the light of their racial uliarities, arts, languages, and social customs, regarded as one and all tributory to their ethnic or national individuality—such investiga- s may be termed ethnological in scope ; and in this sense General hropology may be said to culminate in Ethnology. It goes no further, vever, because it is not a Philosophy of Man, but only a Science of Man ed as directly as possible on his Natural History. It is, in fact, simply a hly specialized and developed branch of Biology, the science of living

nature in general, of which Man is in a way a small part; thou
it is the part which he wants to understand most and on the whole
the best chance of understanding, having an inside-view of himself a
of no other creature.

The other point is that both General Anthropology and its vario
subdivisions draw freely on other sciences which, though to this exte
subsidiary, occupy more or less independent positions of their own, su
as Geology, Physiology, Psychology, and so on. Of these the two m
immediately concerned with Anthropology are, perhaps, Prehisto
Archæology, which is especially helpful to Technology, and Anthrop
Geography. The latter describes the human Environment—which for
with Race and Culture a triad of basic conditions that Anthropology
sumes to be together responsible for the making of Man. It only rema
to add that, while every anthropologist firmly believes his science to
ply to mankind in general, it is only with the more uncivilized kind
man that he is at present free to deal as he pleases. So far, the enqui
who tries to take a biological and therefore universal view of human h
tory has no weight with or control over the student of civilization; w
treating culture of the Western type as an ultimate fact, is consequen
bound to mistake his relative for absolute values. It is for the future
adjust the focus better—to decivilize history, as it were, in the sense
humanizing it more impartially and completely. Here, however, in
cordance with existing custom, only primitive man will be considere
primitive, that is, whether in the sense of old or in that of old-fashion
For, as the French put it, there is a modern as well as an ancient p
history. Pre-history of course only means pre-literary history; and f
tunately there are other historical documents besides books—harder
decipher, perhaps, but sometimes less lying.

Scheme of Enquiry

If a student, for worthy or unworthy reasons, wanted to acquire
rudiments of Social Anthropology at short notice he might be advise
give his mind to two topics, Social Organization and Religion, the st
of Institutions and of Beliefs; and to leave the rest, the Economics
Law on the one hand and the Ethics and Aesthetics on the other, to fi
as best might be contrived. This means that one can broadly distingu
between the external forms in which any human society displays its
tivities and the inner meanings and purposes on which the activitie
question ultimately depend. Man being what he is, and always has b
as far as our backward view extends, namely, a social animal, we hav
right to posit as our datum-fact the human society rather than the hun
individual taken by himself.

To ignore the individual, however, as the sociologist is apt to do, los
sight of the trees in a wholesale but blurred contemplation of the wo
is fatal to a true understanding of our dealings with one another. For
gregarious habit has its limits. The struggle for existence proceeds
however mitigated a form, within each society; while the strength of
social bond would seem, in turn, to depend largely on the support tha
gives to each co-partnership in a fiercer struggle waged with the res
humanity. Whether, however, we base the human society on mutual n

or purposes of common self-assertion and self-protection, or insist rather
n the consciousness and love of kind which certainly helps to foster such
ssociation, the fact remains that for the historian the unitary human
gent whose activities he studies is not this man or that, but a group of
nen forming some sort of body politic and more or less in charge of their
wn affairs.

Given, then, such a society, it will inevitably have a structure, just as if
were really and not metaphorically a body ; while, to pursue the same
nalogy, there will be functions corresponding to the structure. Like the
ody, then, the social organism will likewise exhibit processes of feeding,
reeding, fighting, maintaining health, recuperating by means of rest,
nd so on. In terms, then, of such a morphology and physiology of the
ody politic, we could stop short at describing all the outward manifesta-
ons of the social life. It would be as if one were to visit a foreign country
ithout knowing a word of the language, and were nevertheless to draw
a description of the visible behaviour of the people. Yet clearly such
account would be very imperfect. Another traveller, who was at home
ith the language, would double or rather treble its value by supplying
e motive—the more or less conscious why and wherefore—of everything
at was done.

In short, a Social Psychology is needed to supplement the mere surface-
ew of the life of any given people. For Man is not only the social animal
ut the self-determining animal above all others. The ultimate clues to
s actions must be sought within himself, whatever the behaviourist
ay say. Indeed, a behaviourist philosophy which would explain life ex-
usively in terms of matter and motion is either physical science gone
ad, or, more probably, it is sheer narrowness of education. Here, at all
ents, the human universe will be viewed as if its true centre were the
man mind. What may be broadly termed morals will be treated as the
ue to the social life in the sense of the outward manifestations of the
rsuit of good. The sources of human character will be examined as it
alizes itself in and through human conduct. It only remains to add
at, since we are concerned with mind as something that develops, we
bound to cast back some way into the sub-conscious or even uncon-
ous. It would be fatal to forget that the social mind—so far as one can
k of such a thing at all—has also this side to it. As a branch of biology,
thropology is bound to interpret the history of human intelligence as an
olution proceeding gradually from unconscious instinct on and up to-
rds conscious reason.

So much, then, for the scope and method of the present enquiry.
We shall start with a search for the human instincts. B. We shall next
to discover how, thanks to the intervention of conscious purpose, they
converted into moral sanctions. C. Finally, the ensuing conduct will
considered in sufficient detail to bring out that moral quality which
he only true test of the degree of culture, or self-cultivation, therein
ieved.

THE RAW MATERIAL OF MORALITY : THE HUMAN INSTINCTS

Man has had moral freedom in sight ever since he emerges into history.
meval instinct may retain some slight hold over him, but it has none of

that absolute grip to which the rest of the animal world is subject. T
blinder the response to stimulus, the lower the rate of individual su
vival—such is the law of the evolution of life. Instinct merely ensures th
what is done is often enough right to maintain the given kind in bein
whether one in ten or one in ten million be lucky enough to hand on t
torch. Intelligence, on the other hand, stands for economy in the spen
ing of vital energy. For it implies that, whereas the function of Nature
still to hint that one path for all lies ahead and common rules of the ro
must be followed, nevertheless considerable discretion is left to each wa
farer to pick his own steps. At most, then, our racial inheritance consi
in a vague sense of direction together with a certain ability to keep goi
along this line. The rest is, broadly, a matter of free choice. Instead
instincts that would master us, we have impulses that act as our servan
at any rate so long as we are in a fit state to rule, and are not in t
plight of those sick souls that cringe to some overpowering passion.

An impulse can be recognized by its emotional tone, which preserv
the primitive character displayed at the level of animal instinct. Thu
suppose a man to be suddenly startled, he will feel afraid ; but he w
probably, at the same time, feel curious, or perhaps angry, or else su
missive. All these emotional reactions to the situation reveal the presen
of so many expert assistants, each of them ready to carry out instructio
in his special way at the bidding of the will ; so that the man will run aw
or draw near, or fight, or grovel accordingly. For the psychologist, the
the analysis of the emotions probably offers the most effective means
classifying our instinctive tendencies ; which such a method proves to
many and complex. Here, however, it will suffice to group them mo
roughly by reference to their function of providing morality with its r
material. Now we have a social and an individual side to our life, but
would seem that it is only through sociality that moral individuality c
be achieved ; so that for our present purpose the social aspect should
given priority.

Correspondingly, then, we may arrange the human instincts under t
main heads, according as they are more directly concerned with the clai
of others or with those of self. One can think of them as the instincts th
severally subserve co-operation and competition ; but it must be
membered that they are there, not to pull against each other, but to p
together, since all alike have been evolved as instruments of racial s
vival.

(*a*) *Group-maintaining Instincts:*

In the first group, then, are the instincts relating to group-maint
ance, which can be considered under the three heads of mating, nursi
and herding. Of these functions mating and nursing—in other wor
reproduction and the care of offspring—obviously go close together,
have to be distinguished inasmuch as, at a lower grade of organic life,
one can exist without leading on to the other. Now just as sexual rep
duction is the most direct means of securing the continuance of
species, so it is the most powerful and all-pervasive of the human
stincts ; and it hardly needed the testimony of Freud and the ot
psycho-analysts to remind us of so insistent a fact.

To a corresponding extent, then, the history of morality must largely
rn on various steps taken to regulate this primal urge. Instead of perpet-
l freshets and floods, an orderly flow of this mainstream of the pas-
ons can be brought about only by the most elaborate canalization. So
compromising and severe are the sanctions that from time immemorial
ve repressed illicit forms of love, that the horror excited by the occa-
onal violation of these ancient taboos has come to seem almost natural,
at is, instinctive ; whereas the never-ceasing sense of strain attending a
ntrolled sexuality is enough to remind us that habit, though reputed a
second nature," can never amount to an altogether effortless rule. It
only fair to add, however, that the theorists are by no means agreed as
the precise point at which the line is to be drawn between the in-
nctive and the habitual, the natural and the artificial, the animal and
e purely human. Thus it is still a burning question whether a repulsion
ainst close inbreeding is congenital or, on the contrary, an effect of
rly marriage-custom. For the rest, we are probably entitled, on the
ength of various analogies drawn from other animals, to include in the
-complex certain incidental tendencies, of which jealousy, modesty,
d self-display are leading examples. It remains, also, to note that sex-
stinct in Man is by no means to be treated as a constant, since its in-
sity varies with age and perhaps, to some extent, with season ; while
ere is reason to suspect that vigour in this respect as between the dif-
ent human stocks is not always the same.

Next, as regards parental instinct, we may take its strength, and more
ecially its duration, as a fair measure of superiority in the matter of
ganic development. It is to be noticed that the two parents play dif-
ent, and not always equally onerous, parts in the maintenance, pro-
tion, and education of their young ; the animal world providing cases
which the male, or more rarely the female, is relatively remiss in re-
rd to such duties. In this connexion it should be noticed too that the
pulses to breed and to nurse are so far independent that, just as a hen
l bring up alien chicks, so there is a type of human society in which
others bring up their sisters' children to the utter neglect of their own.

Finally, the herding instinct, though involved to some extent in any
m of family life, may be treated as something specific, inasmuch as
re is a marked difference between the solitary and the gregarious types
animal species. Curiously enough, the man-like apes, to which the
logist is most inclined to turn for his clues to the very early history of
n, are decidedly prone to form small rather than large groups, such as
l favour with other members of the simian tribe, as, for instance, the
oons. It has been suggested that the decisive change occurred when
n became a meat-eater and thereupon found it expedient to hunt in
ks like the wolves. But it is quite doubtful whether he has ever done
On the contrary, the unitary human group of effective common life
y always have tended to be small at the hunting stage of society, when
ormally takes many square miles to feed a few. Be this as it may, man-
d must all along have enjoyed a group-life sufficiently intense to afford
ression to impulses that make either for greater solidarity, such as self-
ordination and self-devotion, or else for better understanding, such
imitation, suggestibility, sympathy and, in a wide sense, concerted

play. Given, then, all these propensities naturally disposing men to dra near to each other, one chief task of morality was to organize them that they should work together for good, as far as the moral life consists co-operation.

(*b*) *Self-maintaining Instincts :*

In the second group are the instincts relating to self-maintenance, a these can likewise be treated as threefold, according as they are concern with self-protection, self-assertion, or self-sustenance. It is for the rac advantage that each individual, however social in his disposition, shou likewise be able to shift for himself, and to some extent at the expense the less able and worthy ; but on the other hand these instincts, thou primarily self-regarding and competitive, exist ultimately for the good the species as a whole no less than do those which immediately furth group-life. Self-protection is clearly the biological purpose of the fe instinct, which in the opinion of the psycho-analysts is exceeded only the sex-instinct in the power of its grip on the human organism, to jud by the violence of its effects in the case of the mentally dissociated. A r markable feature of the fear-complex is the number of specialized rea tions which it comprises. Thus, one may be moved either to run away to keep still in the presence of danger ; while many minor phobias ha been distinguished, each governed by its own form of terror. Indeed, it a nice question whether the anthropologist may not look for an inherit as well as a purely traditional element in the fear almost universally cited by particular kinds of objects—blood, corpses, snakes, and so the strongest case being perhaps that of ghosts. Yet, however differe they may be in other respects, these experiences agree in being “ *astheni* that is, literally, strengthless, involving a lowering of the vitality, a sinki of the heart, as if a reinforced weakness were Nature's reminder to prudent.

The self-assertive type of instinct, on the other hand, such as anger pugnacity, has the opposite function of heartening and bracing. Nevertl less its association with fear is very close, since it needs some sort alarm to set the counter-attack in motion ; and indeed the most timid animals will put up a good fight if brought to bay. It is to be noted, mo over, how intimate is the connexion between the fighting instinct and rivalries of the mating season—a point which well illustrates how apparently self-regarding disposition is really of racial service. As co pared with other animal types that are better armed in respect of tooth claw, Man would not seem to be in general suited to gain his ends much by brute courage as by cunning ; though there is reason to th that considerable differences in regard to inborn fierceness exists various human stocks that have severally adopted aggressiveness or su missiveness as their leading rôle ; for both are ways of survival.

It remains to notice the self-sustaining type of instinct, which in most fundamental form is concerned with nutrition. One hardly kno whether to postulate greediness, or fastidiousness, or the recklessn begotten of sheer hunger, as the natural cause that turned Man int carnivore, or, rather, an omnivore with carnivorous leanings. In any c he has seemingly been hunter long enough to have acquired a spec unting-instinct, which is distinguishable from the fighting-instinct by ie accompanying emotional tone, though in many respects akin to it. hereas anger pivoting on fear is the characteristic note of pugnacity, ie hunting temper subordinates ferocity to an acquisitiveness united ith curiosity, thus involving a certain play of the intellect such as nderlies the sense of sport. Instead of merely seeking to drive away destroy, the hunter is out to assimilate. In place of anger, his disposi- on involves a kind of love and interest, even if it starts as a mere cup- oard-love, a pregustatory interest. Indeed, since animal analogies show unting to be associated with collecting and storing, the acquisitiveness us bound up with hunting, or at any rate with nutrition, is evidently the root of the property-feeling ; and thus plays an all-important part the building up of human culture, seeing that culture on its material de is simply a hoard of properties. It has only to be added that self- stenance is the biological end of the whole health-preserving process vering exercise, cleanliness, and sleep, and we have brought to an end ir review of the organic capital laid up, as it were, beforehand for the uman being to spend at his own discretion—and risk.

In a sense, it is a very rich endowment. We have so many instinctive ndencies that in practice they inhibit one another, and give the will e chance of throwing its weight on this or that side of the balance. uman conduct, regarded in a broad historical way, is anything but tural. On the contrary, it always seems exceedingly arbitrary, not to y odd ; and we should rejoice in the fact, because eccentricity and dividuality are twins. We have broken away from Nature regarded as e sum of the blind impulses pushing us along from behind. Rather, trust to a forward-reaching faculty that depends more on hope than ion ; and are engaged in a campaign of experimentation on so vast a le, that every petty people has diverged into habits of its own on ich it stakes its very existence. Thus, at the far end of the historical ocess we clearly discern an animal of uniform type which differs m the rest only in being somewhat over-endowed with instincts and a like extent unspecialized and unstable. Yet, at the near end, repre- nted by the present, we find the lineal descendant of that same animal oying an amazing variety of experiences ; out of which, were he as se as he is ingenious, he might surely select the make-up of a good life.

B. THE MORAL SANCTION: CUSTOM

n escaping from instinct Man might seem, at first sight, to have but en into the hands of another and a worse tyrant, namely habit. For a bit is, in a way, an accidental precipitation, and hence a limitation, of instinct. The first reaction that happens to occur tends to repeat lf, with the result that other possibilities of impulsive response are ppressed. Thus, one of the firmest postulates of the psycho-analysts is t some single experience in very early childhood may produce a sistent emotional bias ; so that, for instance, a life-long horror of s may result from one infantile encounter with an aggrieved kitten. too, then, accident has left many traces on the history of human iety. Moreover, whereas individual habits are not transmitted to the next generation, social habits—in other words, customs—can unde primitive conditions have an almost age-long duration.

Such continuance, however, depends on some sort of disciplinar system which brings a steady pressure to bear on every member of th group. Apart from it he would have no such social habit at all, and despi it he is ever ready to deviate from the average line of convention conduct. It is but slowly that society learns to distinguish betwee deviations for the worse and deviations for the better, and to this day n sure criterion exists for differentiating the reformer from the crimina Early politics being petty but desperate, a life-or-death affair, no ris are taken, and a premature martyrdom is apt to overtake the innovato not to say the genius. Travellers who know the savage well do not fir him by any means lacking in originality; but they universally testi to the strictness of a social code which recognizes but one type behaviour as incumbent on all.

We have, then, in a word the character that marks off primitive fro advanced morality, when we say that the former is customary. Right wrong for the savage is simply as custom decrees. It makes little differen whether one considers the matter from without or from within. N only are the traditional rules enforced in their entirety, but likewise their entirety do they feel and seem obligatory to everyone involve These two aspects of the moral sanction, the external and the intern are worth examining at greater length.

(1) *External Aspect*

Externally viewed, the moral discipline to which the individual sava is subject from the cradle to the grave depends on a social organizatio an established scheme of co-ordinated activities. As when a boy joi his school, or a young man his regiment, the new recruit is faced wit curriculum, a drill, to which he must outwardly conform whether likes it or not. At first he is almost bound to resent being licked in shape, especially as the licking is not all done by means of the tong His natural plasticity, as it were, registers an inward protest against stiffening that is relentlessly exercised by the mould. In time, howev there steals over him a sense of inevitability that ripens into a posit acquiescence in a set of rules, the real purpose of which may even n be scarcely understood. If anyone has a clear idea of the meaning a value of the whole set of arrangements, it will be the authorities, elder folk, in charge; but they in their turn have been through the m and, in proportion as they are supine and stupid, will be content to ca on in a mechanical way. A test of the relative intelligence with wh they perform their duties of instruction will be the extent of their relia on persuasive as contrasted with purely coercive methods. Obviou they are likely to convince just in so far as they can show reason for w is done. It must be noted, however, that the reason implicit in mora is as much an affair of the heart as of the head. Unlike logical reason which, at least in appearance, moves forward, ethical reasoning alw looks back in order to justify something that all along has been more less self-evident, namely, the goodness of the good life.

A great deal, then, of the desirability of any orderly mode of social xistence needs no explaining any more than does the swing of a good ance; and, so long as it goes with a swing, one kind of dance is almost as tisfying as another. The trouble is, however, as we have seen, that in ocial no less than in individual experience accident has a way of twisting nd cramping the play of natural impulse, so that it is difficult to recover om bad tricks that have been picked up at the outset in some casual nd almost insensible fashion. Thus the function of reason in morality largely the negative one of purgation; for it is only by realizing that e tricks are not part of the style, but on the contrary are so many npediments and contradictions that interfere with the pleasant rhythm the social round, that men slowly accommodate their concerted actions one of those relatively equilibrated systems of controlled impulses hich are healthy and therefore happy. Now no savage society has yet quired any considerable power of self-criticism, so as to expurgate its stoms by reference to its own dominant notion of good. Though it ay be vaguely aware that it has got into bad ways, it cannot break with em because it has not yet learnt to look them in the face; for, if once ey have been brought into manifest consciousness, they can be mas-ed. Thus it took civilized society a long time to face the evils of slavery, spite all its skill in clothing its sentiments in articulate language. ow much more difficult, then, must it be for a body of savages to rid elf, say, of human sacrifice, however loathsome and burdensome such institution may proclaim itself to the feelings of all, so long as it is t seen for what it is in itself apart from the salutary elements of the igion with which it is confusedly associated? In what follows, then, r chief interest must be to note how far intelligence enters into the cial drill—in other words, how far the reason for the rules prescribed given together with the bare order to conform.

Law

On its purely coercive side, custom is equivalent to what an advanced iety knows as law. What Bagehot calls “ the persecuting tendency ” alive in every human breast, as a boy at school soon finds out if he parts from the ways of the majority. Moreover, every crowd follows leader, so that there will always be some whose authority, however efinitely exerted or recognized, governs the actions of the rest. Again, uman society is a crowd which remains in being through constant ruitment on the part of the newly born, who during their long pupilage bound to find their leaders among the elder generation. Some sort of ental discipline, in fact, is the natural beginning of law; and indeed ily jurisdiction remains an important branch of legal procedure oughout the incipient stage of its evolution. So early, however, is the at which the lesson of obedience is learnt in the savage home, that hin its purely domestic range primitive morality is apt to seem almost omatic, and punishment is rarely administered or required.

Nevertheless, within the domestic group, which tends to be a one-d affair consisting of the mother's people or the father's people—former system being presumably the earlier—there are fundamental s to be observed, such as notably three:—to avoid sexual relations with group-mates ; to avoid killing them ; and, if they are killed by outsiders, to kill these in turn. These three laws of the blood are s engrained in the moral nature of the savage that one is tempted to overlook their social origin ; which must be traced back to very ancien insistence on the domestic proprieties, possibly on the part of the mother whose blood was the symbol of social decency and honour. Nor need w suppose that any mercy would be shown to the rare offender against th laws of the blood, a moral leper whose unclean presence was intolerabl

On the other hand, outside the domestic circle were other groups wit which less sympathy would be felt, since the ties produced by intermarriage would be offset by vendettas and other sources of quarre Thus when any sort of tribal organization involving a central authorit comes into play, a far greater difficulty is experienced in bringing th pack to heel, and the situation demands a more liberal use of the whi It is in fact a case of fighting down the tendency to fight among themselves, and this is rarely accomplished without the interposition strangers who impose social order in their own interests in the form servitude—an unwelcome discipline on which all civilized peopl must, to some extent, look back. Hence, it is not until tribal societ with its more or less loosely organized system of kin-groups on o social level, gives way to the class-system which is characteristic of nascent state, that a strong and centralized law comes into force. Up that point such punishment as is publicly enforced may mostly be treat as a by-product of religion.

(b) *Religion*

In a way religion may seem just as coercive as law, or even more s inasmuch as its prohibitions are backed with threats that take the for of curses. Such curses, moreover, are wont to take effect palpably and once, since primitive society, in order to avoid universal pollution, prompt to rid itself of the offending member by a sort of surgical oper tion. Thus, humanly as well as divinely regarded, a sin is even mo deadly than a crime. The real sanction, then, of custom in the ea society is that it is largely sacred. It is unforgivable to do anything like to bring ill-luck on oneself, because ill-luck is catching. There can no arguing about the utility of a taboo, namely, an avoidance resting a religious sanction. It is unconditional—something that simply cann be done. Even when a man is punished for acting in a way that is obvious prejudicial to the public advantage, the savage is apt to invert the reas for his fate by supposing that he must have brought a curse upon hims or he would never have behaved so badly. This sacrosanct charac which attaches to tribal usage, entailing a ceremonial punctiliousn that extends to the last detail, affords the true explanation of that cons vatism which the civilized man who comes into contact with the sava finds so unreasonable, because it rests on no plain grounds of comm sense.

It is easy, however, to overlook the fact that primitive religion is all negation, but has its positive side. To observe taboo is to enjoy *ma* namely, spiritual power, or strong-heartedness, an equally infectio thing. So long as the group can feel that its collective luck is intact sure of itself. Call *mana* morale, and one can see how spiritual welfare more important than temporal welfare to hard-pressed folk ever on e edge of starvation, whose native pluck is their one permanent stand-. Thus the old-world community is not wholly to be blamed, if it ds the adoption of improvements, pressed on it by some alien culture, out as hard as it is for a civilized church to alter its prayer-book. e root-feeling is a sort of veneration for the ancestral wisdom and ty that have made the people what they are, that is, what they would e to believe themselves to be. Their theological justification for such entiment may be rather mixed, conceived as it is likely to be in terms totems,[1] ghosts, nature-spirits and so on. But the quantitative effect the moral sanction is in direct ratio with the qualitative, because the ial rule is infinitely more binding when the tremendous import of divine is superadded. Savage faith—or, as some would prefer to say, mitive credulity—is strong ; so that, for instance, an oath is no vain m, but suffices to turn a human trial into what our own Middle Ages led a " judgment of God." A secular law may always be dodged ; there is no dodging a conviction of sin. Indeed, nothing is wrong h the spiritual armour of the savage except that it is inelastic.

Education

Vhereas coerciveness is a leading feature not only of law but likewise eligion at the primitive level, since on the whole it might be said to more conscious stress on the fear of taboo than on the hope of *mana*, re are also gentler influences at work that more or less persuasively lcate good behaviour. As for the moment we are considering the al sanction on its external side, we can ignore all that the individual s up for himself, living as he does cheek by jowl with his fellows taking part in everything done or suffered by the rest. Teachers, ever, are not wanting to school him in his tribal duties. Until the age uberty, as a rule, nothing systematic is attempted in this way, and e is learnt in imitative play than from the direct injunctions of nts and kinsmen. On the other hand, when as often the initiation monies are of an elaborate and prolonged character, the novice ergoes a disciplinary course that is calculated to make a man of him ny cost to his private feelings. In Australia, for instance, apart from od deal of terrorism, conjoined with symbolic rites intended to note bodily growth, there is no little instruction of a doctrinal kind l that pertains to tribal lore.

is to be noted that these tutorial functions are exercised, not by the h's own kinsmen, but by the males of the group into which he is ned to marry, who thus make sure that he is worthy of such an nce. Incidentally, this give-and-take between the kins in the matter e training of the young shows that one and all are being taught to more than a domestic view of their moral duties, and, in a word, to and think tribally. It is no wonder that, when with advancing years play an increasingly prominent part in these and other solemnities, nore intelligent acquire a good working knowledge of all the niceties of the customary code. Thereupon they proceed to sit with the rest the experts on more or less formal councils which, though largely admi strative, would seem occasionally to introduce changes amounting fresh legislation.

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[1] See Glossary, p. 430.

Moreover religion, even when of the rudimentary type, does entirely lack the individual note ; and the inspired man is permitted indulge in innovations that militate against ritualistic stagnation. In fa in its small way tribal life keeps the mind busy with affairs that, if carri out without much discussion of principles, are nevertheless so imm diately before the eyes of all concerned that their bearing on the gene welfare is never in doubt. In savage society one does not need to thi much about a duty that stares one in the face. At the same time, too, on neighbours are only too ready to point it out, if they deem it necessary do so.

(2) *Internal Aspect—The Pre-ethical Conscience*

To suppose that the savage has no sense of right and wrong is, course, an absurd mistake. He is inwardly guided by standards that, i way, have all the more hold upon him because they are uncritical a unreflective. In the orthodox man " the native hue of resolution " is " sicklied o'er by the pale cast of thought." He is secure in his judgme and correspondingly vigorous in his actions until a new situation fi him unprepared, when all becomes confusion. It is notorious how utte a primitive community becomes demoralized if suddenly forced change its customs. To the average member of the static type of hun society there seems to be only one possible way to behave. He has ne tried to analyse his moral system into its elements, so as to discover th separate values apart from context ; and so he cannot distinguish betw principles and details. Since therefore he cannot pick and choose in bestowal of his appreciations, which extend indifferently to everyth sanctioned by convention, he may be said to lack moral freedom.

It is but just to note, however, that this is hardly needed, inasm as no free career lies before him. As Maine puts it, he is subject t regime of status as opposed to one of contract. His duty is to live acco ing to the station to which he is born, not to go forth experimentally seek whatever station will accord best with his opportunities and mer In a dynamic world, then, a man has to invent a moral character, wher in a static one he has simply to imitate one. The savage, as it were, fi his part ready written for him ; so that his business is but to rende correctly and not to " gag." Consequently, any departure from cust offends his moral sense, very much as a child dislikes hearing liber taken with the words of a well-known story. Moreover, primitive ort doxy is essentially a crowd-consciousness, and it is hard to resist feeling that whatever everybody says and does must be right. The c glimpse that the savage gets of another point of view under a cl system is through marriage into another kin, which at all events probably another totem and a few ceremonies of its own, though and the same general level of outlook prevails throughout. Morals short, amount to hardly more than tribal good manners. To do wha not done is the mark of the impossible person, who being strang

clean—unless, indeed, something superlatively forceful in his excep-
nal behaviour causes him to be accounted holy instead.

Wrong, then, in the savage eyes is more or less equivalent to taboo.
stands for everything and everybody that a plain man should shun.
e standard by which it is judged is intuitive and almost æsthetic. It
a matter of good taste to recoil from anything so immediately offensive
the well-bred. It must be kept at a distance because one cannot touch
and remain pure, that is, a healthy member of the community. Since
cial health is identified with unanimity, the toleration of something
en must act like a spreading sore. Loss of conviction will entail loss of
nfidence, and the savage society that has lost its nerve is doomed.
deed, there is here to be noticed a sort of echo of that herd-instinct
ich expels the sick or wounded beast. It is unsafe to live with it, and
s is enough to condemn it. So too, then, savage justice takes little
count of motive. Whether by his own fault or by sheer misfortune
offender has done something whereby he forfeits his right to associate
th the rest. No excuse can alter the fact of his infectivity. Nay, he may
eady have conveyed the taint to his immediate surroundings, so that
and his alike will have to be banned.

As for right, on the other hand, this means for plain folk to be respec-
le—to stand well in the public favour. The man in the crowd may
nost be said to think of himself in the third person, so much does he
ply a crowd-judgment to the figure which he cuts in society. Of this
terior self he is exceedingly conscious, but of the intimate self within
rdly at all. His moral personality is worn like a garment cut to the
hion, and he is uncomfortable in proportion as he feels untidy. Con-
riwise, a sense of being well-dressed is the very secret of his strength.
hardly counts it suffering so long as it makes for a braver show. His
bition is to live in style—to be in the centre of the picture.

It must be remembered, however, that in the static type of society the
pearance is in close keeping with the reality, since there is little to do
ich cannot be copied. There may even be a sort of intensive progress
ieved by constant efforts to improve on the same model. A heightened
rale will inevitably result if everyone strives to shine in the eyes of his
ghbour. After all, much human energy is dissipated in making fre-
ent changes, and it may well be that the more conservative type of
man society has more gusto to throw into its untiring repetition of the
niliar. The very sacredness that is imputed to the ancient and tradi-
nal would seem to indicate that old acquaintance is needed to stir the
per feelings; and, if a certain shallowness be observable in modern
lization, it may be because the pace is too fast. The moral experience,
n, of the ordinary savage is not shallow in the sense that it fails to
ch a deeper self in him, but in another sense it is, because this is a
eralized, collective self—one that imposes the same set of repressions
liberations on all alike without regard to the variable element in
nan nature. It may be that savages breed more true to type than hap-
s in the civilized society that is composed of many racial strains.
n so, though to wear the conventional self may afford sufficient play
he average man's nature, it is decidedly hard on such misfits as occur.

t remains to consider the psychology of the leader of a primitive society ; and this presents peculiar features. Among those who exercis more or less authority over the rest we can distinguish two classes whic might be termed lay and religious. The first of these, which is altogeth less important or even typical, is composed of those who simply repr sent the flower of the conforming majority—those who have made them selves conspicuous for bravery, liberality and whatever other virtues a generally admired. In a way these men of high average attainments for the very backbone of the tribe. And yet it is not to them that their socie is apt to turn at times of crisis ; for their strength lies in dealing with t normal.

To the second class belongs the type of man whose pre-eminence res on a claim to supernatural power—*mana*. The two classes shade off in one another only in so far as any outstanding merit or success carri with it promotion from a lay to a spiritual status. *Mana*, however, conditioned by taboo—by a precautionary withdrawal from the comm pursuits of common folk. Broadly speaking, a man's holiness is propo tionate to his remoteness. He must reserve himself for critical occasion if he is to intervene convincingly when nothing but a miracle will sa the situation. Thus he has a chance of developing a mentality differi from the crowd-consciousness of his fellows. By virtue of his social pos tion he is thrown back on himself—introverted ; while probably he likewise, by his natural bent, disposed to be a dreamer. William James his *Varieties of Religious Experience* has attempted to analyse the state mind of the civilized visionary ; but neither Christian saint nor Hebre prophet can compare with the savage seer in respect to the obscurity his thought-processes, which barely emerge above the level of the su conscious.

Especially hard is it to frame a moral estimate of the character th goes with this high-strung kind of temperament. From the standpoint common-sense it is decidedly suspect, fluctuating wildly as it does, that now it seems inspired but now fraudulent, now reaching towards t divine but now descending to the devilish. It may be then that the extren cases serve mainly to impress the crowd and render it submissive, a that the real leaders of society are rather the men in whom ecstatic gi are less in evidence than is a capacity for state-craft. Even so, the me profession of sanctity entails a certain isolation that is favourable to se communing and hence to the development of individuality. Leadersh goes with independence of mind such as is denied to those who have inner life.

C. THE WORKING OF THE SANCTION : MORAL ACTIVITIES A VIRTUES

Our final task—and one that, if carried out in any detail, would take far—is to examine the effects on human conduct and character of morality of the customary type. We are trying to extract from the h torical facts some answer to the question—What kind of good is to be g from a life that is ruled mainly by habit ? A rational ethics suitable t modern society might not be prepared fully to endorse Clifford's parado “ It is not right to be proper ” ; but it would certainly go far towa ncouraging a critical attitude toward current practice and opinion, for the urpose of distinguishing principles of lasting value from the accidents nd whims of the moment. At the same time, our world finds it hard to evise a system of moral education that will produce the good man who at once broadminded and of strong character, because the heart lags a ng way behind the head in adaptability, or, in plain language, emo-onal as contrasted with intellectual tendencies are inelastic if once they ecome set.

The savage, on the contrary, has no need to think about his duty, be-use the sentiments drilled into him early in his life can be trusted to last m to the end of it. He has the negative strength of the narrow-minded—sort of obstinacy. He cannot die alone for a new principle, but he can e with his fellows for the old country and its old ways. His tragedy is at, brought suddenly into contact with a dynamic world which has little mpathy for his slowness, he must perforce be the martyr of a lost cause. evertheless, he is not an animal, with instincts that must literally be bred in him if they are to be changed. He is a man with a culture, the tificial product of an education that must be constantly renewed if the lture, and through it the man, are to survive. His education differs from rs only in so far as it offers the individual the choice of only one kind of oral personality. It is a one-pattern system of tailoring. Fortunately man taste is so various, not to say arbitrary, that every little community e savage world over has struck out something characteristic in the way a style; so that it is, indeed, mostly because it is the heir of the ages at civilization has become so diversified a bazaar of fashions.

For the moralist, then, human culture is primarily an educative pro-ss, and it is in this light that we must here consider the advantages and ortcomings of a customary regime as illustrated by savage life. As the stincts were found to fall into separate groups, according as they chiefly d group-maintenance or self-maintenance for their biological end, so will be convenient to distinguish moral activities, together with the rresponding virtues, under a like pair of heads, according as they ainly serve to foster sociality in the group or personality in the indivi-al. The raw stuff of which human nature is composed consists of these o threads; and, however much they may intertwist, education, which as it were the dyeing process, allows the difference between them to pear in the finished article.

(1) *Activities making for Sociality*

Domestic Virtues

The social life in a sense embraces all living humanity, not to speak of other dimension in which it extends from our ancestors to our descen-nts. Within this somewhat indeterminate tissue of inter-personal rela-ns, forming what might be termed the body of morality, all our col-tive activities take shape round a number of lesser centres. Thus, eryone belongs to some sort of body politic which provides him with unit of social reference. Within this nucleus, however, there is always be found a nucleolus or core of intenser sociality, the very hearth and rsery of the group-maintaining instincts. We can call this the home circle, since, as will presently appear, the term “ family ” has to be use in a rather unfamiliar way if it is to cover all the facts.

Here, then, we have the groundwork of a triple classification of Man social activities, according as they are domestic, tribal, or inter-tribal. W can think of every individual as ringed round with these three concentr spheres of duty towards his neighbours, who experience the warmth his charity in a declining ratio at each remove of distance. To reduc these three degrees of social sympathy to one must be the abiding hope ethics. Yet, since morality is more a matter of quality than of quantity, th can only be done, not by substituting a correct but cold cosmopolitanis for the old affection felt towards home and country, but on the contrar by promoting moral individuality, so that each member of the constell tion should, as it were, throw out more heat for the benefit of the enti system. Charity must always begin somewhere, though it need not en there ; and for this reason the touchstone of the moral condition of a give people is best sought in the quality of its home-life. Without intimac there can be no love.

How, then, are we to conceive the earliest kind of home ? Do wh one will, one cannot prevent history tailing back into pure mytholog and science can but see to it that facts and inferences are kept distin At most, then, we can frame a fairly accurate notion of the general cond tions of human life in Europe for, say, the last twenty millennia, a matt of about a thousand generations—quite a short span if reckoned in term of biological process. This northland type of man, fire-using, tool-makin cave-dwelling, was in culture already a long way ahead of forebears wh must have surely picked up the rudiments of living humanly, or at lea sub-humanly, under far easier conditions of climate, when they cou camp in the open and find a sufficiency of animal, or at any rate, vegetabl food at all seasons. Dense forests would not suit their habits so well rather open country, such as would likewise favour wandering an dispersal. The size of the separate bands would depend on the foo supply, and it is in economic terms that one must chiefly calculate t strength of the social bond. So long as gathering prevailed over huntin in which department a more or less weaponless man can do little on effective scale, the females of the group would be economically almo independent of the males ; and, if they had fire, they might even large dispense with their protection. On the other hand, their child-bearing an nursing functions would render their life more sedentary than that of t men-folk, especially after the latter had progressed in hunting skill an become addicted to the joys of the chase. Nor need it be supposed th the claims of sex would permanently enchain the males, so long at a rate as mating was mainly governed by season. On the contrary, o might suppose that breeding-time would be the moment when intesti rivalries would periodically threaten to shatter the usually placid inte course of what was primarily a “ syntrophic association,” in other wor a food-group.

Thus it is probably quite wrong to imagine the primitive horde essentially a harem owned and guarded by an ever-jealous patriarch– sort of Grand Turk. With just as much, if not more, right could o compose a myth of Amazons who are economically self-sufficient enou

be able likewise to retain the initiative in the bestowal of their favours.
sing their authority as mothers to stop in the young what they could not
well prevent in the old, they might at length succeed in putting their
n—one might almost say their curse—alike on mating and fighting
thin the home-circle. Given the proximity of more or less related and
endly bands, there would be no great hardship in obliging the young
en to go abroad on amorous visits, especially when once it was under-
ood by their neighbours that the compliment could be returned. Be
ese guesses sound or not, human society as we know it can provide
amples of a well-established type of domestic communion in which only
e parent is represented, namely the mother. Supported by her breth-
n, she manages her children without the father having any say in the
atter ; for he is but a stranger from over the way, just as her own breth-
n are strangers to the women with whom they go forth to consort.

Thus the basic principle of such a household is that those who feed
gether must not breed together—that sex is a disturbing factor that
ust altogether be suppressed within the home. It is usually known as the
v of exogamy ; but the term is not very happy in that it seems to render
e rule as " Marry out," whereas its real import is, " Avoid incontinence
thin." The absolute stringency of the taboo may be taken to argue for
great antiquity ; while the fact that incest is universally regarded as an
ence against the sacred blood constituting the mystic bond of kinship
ints to its origination in the kind of group of which the breeding
omen formed the rallying-point and centre—in a word, stood for home.
nce savages are still to be found who do not understand the physio-
gical side of fatherhood, it is a fair assumption that in early times the
other would be credited with the entire responsibility for the child ;
ile not only childbirth, but other mysterious incidents in the life of
man, would serve to make her blood at once a great taboo—a source
disaster for the heedless—and a thing full of *mana*, the natural symbol
the collective being and luck of the group.

Now, taken in its purely negative capacity as a rule that prohibits inter-
eding between group-mates, the law of exogamy displays complete
ifference as to what sort of sexual relations are formed outside. There
othing in what it prescribes to prevent sheer promiscuity so long as it
confined to dealings with strangers. On the other hand, it might be
umed that sexual selection would not fail to operate in some degree; or,
other words, that individual mating preceded by some rude sort of
rtship would prevail, even if it by no means follows that the ties thus
med would last for life. For exogamy merely implies that one can mate
h any stranger, not that one must mate with all strangers without
inction. In short, it indicates one's " marriageables," not one's
ual spouse ; so that the theorists are wide of the mark who would
uce an original promiscuity from the wide terms in which an exo-
nic marriage-licence is cast. On the whole, we can but suppose that the
ation of the union would depend on the amount of cohabitation in-
ved. A more or less furtive assignation in the bush, or a liaison con-
ted in the course of some collective visitation of the youth of the other
p—for such saturnalian invasions occur to this day, and, as we hear
n the Trobriand Islands, it is not always the young men only who thus

go forth to conquer—could create no real partnership, no joint interest i a common hearth and home ; whereas an attachment involving residen with the woman's group, or at any rate assistance rendered to it in th shape of presents of food and so on, would ripen eventually into a fir union.

In the existing societies that practise the extreme forms of mothe right[1] this kind of " labanism," or marriage by service on the part of th husband from without, is already for the most part in vogue. As in eac group life becomes gradually differentiated, so that each woman with h brood tends to have a fire and shelter of her own, and perhaps a gatherin ground destined eventually to become a hoe-patch—for agricultu almost certainly starts as the woman's business—there will be a corre ponding appropriation of the husband's services to the particular needs the wife and her family. As soon as he helps to minister to her priva necessities, his domestication has begun, and the claims of their comm home begin to outweigh the duties that he owes to his kin. His kinsfo for their part, however, long continue to regard him as having no rig thus to rob them of their time by pandering to the wants of aliens ; an if he does, are apt to require compensation for the labour that he has p into his wife's house or plot of ground. In such minds the very notion the family as a bi-parental affair has scarcely yet taken shape.

It remains to note a consequence that is liable to disturb the peace o group organized as a motherhood, if the stranger is tolerated as a visiti squire of dames. What if mother and daughter compete for the attentio of the same man, or he for his part uses his opportunities to throw over older woman for a younger ? A rule that lovers must not look beyond the own generation will clearly make for group solidarity, and, however may have come about, can be discerned at the back of the taboo of t mother-in-law—the most rigid of those avoidances which accentuate t separateness of all who marry under the law of exogamy. Whereas sexu relations between kinsfolk are offences against the blood, this does n hold of intimacy with the mother-in-law ; and yet this too is reckon incest—a fact which incidentally proves that it is not instinct, but soc convenience, that is the real sanction of these fundamental prohibitio That " marriageables " must belong to another kin, but to the sa generation, are roughly the two clauses of the exogamic law, coveri every kind of inter-sexual connexion from a casual flirtation to a partne ship for life.

Hence we find Australian tribes who label themselves according what is known as the four-class system, which uses different nam firstly for alternate generations, and secondly for the inter-marryi sections of each of the pair. Thus of every four women a man knows once by their class-names, while conversely a woman knows about eve four men, that only one is a possible mate, namely, the one belonging the opposite section of the same generation, while the other three immediately recognized as ineligible. It is worth repeating, howev that this does not in the least mean that the cross-sections of any o generation are promiscuous in their relations. It would be just as absurd infer that we are promiscuous within the limits indicated by the table ohibited degrees in the prayer-book. Marriage within a class and rriage by class are utterly different things ; and the chances are that ıen Aristotle described Man as a " pairing animal " he was not far ong, however much the savage may be inclined to repeat, and thus ıltiply, the pairing process.

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[1] See Glossary, p. 430.

A great revolution came about when somehow kinship came to be koned as relationship on the father's instead of the mother's side. It is etty certain that the change was not due to a recognition of the physioical function of the male, because there are patrilineal peoples in exisce whose theory of how babies come is still on a par with nursery tales h as that the storks bring them, or that they are found under the oseberry bush. On the other hand, the chances are that relationship at t implied physical contiguity—in other words, being born and bred the same local group. Whenever, then, it became the custom for the les to bring home their wives, allowing their sisters to be similarly ried off to strange camps, there would really be very little point in inguishing the children by the separate group-names of their mothers ; ny rate unless these connexions with outside were allowed to override ir prime duty, which is obviously to support their own daily comions.

Even if it be granted, then, that the earliest kins were at once matrilineal matrilocal as the only way of accounting for the facts that bloodtionship and the blood-avoidance involved in exogamy relate priily to the mother's blood, it might well happen sooner or later that a of revolt of the man might occur, whenever mating had come to neceste enough cohabitation to make service with strangers altogether too rous. If, for instance, there were a great disparity in numbers and ngth between neighbouring groups, the male members of the more erful one would be sorely tempted to make their brides come over to r own side where food and protection were more easily to be obed. Having once asserted their authority in the form of wife-capture, would retain it in any wife-exchange that was almost bound to le, since under the new system their sisters had still to be provided mates ; and, after a longer or shorter period of mixed nomenclature ng which the children lived with their fathers but retained the kin es of their mothers, the paternal group-name would be adopted as e suitable to express the social unity that comes of living together and g as one body.

might seem, indeed, that at this point a bi-parental family ought to e into existence ; so that henceforth the child should be recognized as nging more or less equally to both sides of the family. To some extent a result would actually seem to follow, and we often hear of cases e the father and the maternal uncle alike exercise an authority which, ever, is never so much joint as rival. It depends on the closeness of elations between the various kins, how far interference with each 's concerns is tolerated ; whereas, if they remain more or less ally independent and even hostile, it is clear that a son must make up ind whether he pulls with his father or against him.

ere is, indeed, a moral principle deeply engraved in the savage mind stands directly in the way of the possibility of anything but a one-sided family under any system organized on the basis of kin. This is t duty of blood revenge. Two laws of the sacred blood have already be considered, which forbid the violation of its purity by either marriage murder—the two abominable sins of the early world. But there is a thi law hardly less cogent, namely, that of wiping out the alien shedder kin-blood. This is not a taboo but a positive injunction, and therefo perhaps involves a slightly more conscious attitude than that of recoiling horror from an act of pollution. But, if it be not obvious that the sp blood of a comrade cries for vengeance, the funeral—and we know t funeral ceremonies date back to Neanderthal times, say, twenty thousa years ago at least—is bound to excite a wrath proportionate to the sorro Seeing, too, how prominent a part is played by the loud-lamenting wom on such occasions, we can understand all the better how the cry of outraged mother's blood makes itself heard. It remains to be added t the savage has scarcely any idea of a natural death, being little acquain with disease, which is proportionately mysterious when it comes, while the other hand he is exceedingly liable to some sort of violent end.

It is not unreasonable of him, therefore, to generalize all such visi tions alike as murder on the part of persons unknown ; and the fact t the aggressors have escaped notice is got over by supposing that t must have achieved their fell purpose by means of an invisible mag Thus in Australia one must always slay a stranger—it matters not wh may be, since collectively the outside world is guilty—if the grief indignation exerted by a kinsman's death are to be allayed according custom. How, then, if one is perpetually persecuting vendettas with inter-marrying kins, is one to settle down with them to an amicable di sion of interest in the offspring of a given marriage ? Thus, let us supp that a father has been slain, whether own or collective, by an un whether own or collective. On a patrilineal interpretation of his duty, son takes up the feud, but on a matrilineal view of it he must stand guard against reprisals. Just so, when two modern nations are at war, international marriage does not constitute the children neutrals, but t are torn between conflicting duties.

If, however, a one-sided mother-right is replaced by a more or equally one-sided father-right, a radical alteration is required in the l of the blood ; and, indeed their original meaning and sanction h gone, since all-one-blood can stand only by a very forced metaphor anything but all-one-mother. All-one-name, however, is a possible s stitute as a symbol of unity, a sort of war-cry. As soon, then, as the l group of men who make their wives cross over are ready to rally to s such common badge, they have a peg on which to hang the old obligat not to inter-marry, not to inter-destroy, and to slay the slayer f without. Such a name and badge will probably be a totem, which, volving the idea of some relationship with, as well as through, an anin kind or plant-kind, would help to invest the bond of fellowship, wh is now simply a local tie, with a mystic significance likely to enhance binding and sanctioning force.

As for the origin of totemism, a vast and obscure subject, it will enough to suggest here that it is not likely to have come into existe with the patrilineal kin, if this is later than the matrilineal, but m obably goes back as far, or almost as far, as the parallel institution of exo- my. In that case, since the totem would be ultimately connected with ood-group that was conscious of its unity through the mother's blood, association with animal or plant giving rise to the common name uld presumably arise in one of two ways. Either it would have to do h their staple-food, so that for instance they would be known as the tle-men if they ate turtles, and understood the mystery of hunting and mouring the turtles; or else it might rest on some notion that the mother's od was stimulated into childbirth by what she ate, or possibly by what did not care to eat, during the nervous months of pregnancy. Be these esses sound or not, the almost world-wide distribution of totemic ignations, with implicated beliefs at least generically similar, would ue for the great age of the institution ; so that, if father-right is rela- ely late, it would have had the totem-name ready to hand. Moreover, s would already possess a sanctity peculiar to itself, such as could ke a group of stay-at-home fathers appear one body, not exactly as a herhood—for they may have still been fathers without knowing it— rather as a brotherhood, who, because they were all named after only mal or plant, were bound to enjoy one *mana* and to observe one set of oos.

Vith this complete reversal of the point of view from which relation- p is regarded under father-right, the mother's position changes for the rse. It is indeed sometimes thought that, however matrilineal and at same time matrilocal a human group might be, it could never be tripotestal in the sense of woman-governed ; the reason being that the scle is all on the side of the male. Now even if this be granted—and, ough less heavily built, the primitive virago may have been both gh and fierce—authority has its moral as well as its physical founda- s. If the earliest law and religion centre round the sanctity of the her's blood, she—that is to say, the plurality of mothers from which group drew its life—must enjoy a standing, as a sort of queen-bee he hive, that cannot but ensure her a certain dignity and even power. r all, under mother-right every male, in so far as he plays the hus- d, must experience for the time being a sort of inferiority-complex, ne who exists on sufferance among strangers ; whereas the woman- have all the while the uplifting sense of being at home with their oundings.

ut now let the process be reversed, so that the woman must quit the e of her youth, not temporarily, as under matrilocal conditions the is apt to do, but so that her lot is exile for life. As they phrase it in onesia, she must perform a " deer's jump." Her people will have n what is usually known as the " bride-price " for her, though it is y the price of the children that she is going to bear for the benefit of other group. Hence they are in honour bound to have nothing more with her ; or at most may be on terms of distant politeness, address- her as " you " instead of " thou." The last thing that they desire is e her sent back to them, because this means that for sterility or some cogent reason she has been divorced and disgraced ; so that the iage-price must be returned, unless a sister will be accepted as a titute.

From her point of view, the transaction in which she seems to us to figure as a mere chattel handed over the counter is not so degrading as might appear on the face of it. She has cost something to acquire, and her husband and his people will value her accordingly, if she does her mothering amply and well. Her real trouble is that the female society into which she now enters is without cohesion, a mixed lot of wives assembled from various quarters, and hence more likely to be jealous of each other and quarrel than to combine to keep the males in order. Even though under the new system her relations with her husband are likely to be more close and permanent, yet so long as the sexes live and work more or less apart, as is usual in savage society, she loses more than she gains, by becoming an individual mother instead of what once amounted almost to a collective one. Group-affairs as such henceforth concern the males only, and a domestic policy in which the woman is consulted shrinks to the question of how her particular brood is to be reared and fed. She can have no part in the rites that concern the local god or totem ; for its *mana* is independent of her blood or that of any other mother, and requires a new theory that somehow gives the united fathers the credit of passing on the corporate life and luck. Religiously, and therefore legally and morally, the inferiority-complex passes to the woman.

Economically she may be no worse off, and she may taste the petty triumphs of a queen of the harem ; but the glory has departed. She is now little more than a counter in a game played by men. The days being long over when gathering was the mainstay of human existence and she could vie with the male as a food-getter, she was destined to become ever more parasitic on the man as greater demands were made on the strength and skill necessary for big-game hunting, herding, advanced agriculture that involved the use of traction-animals, and systematic predatory fighting. As for her sacred character, to which the mystery of child-birth formerly bore witness, such a notion always fluctuates in savage religion between the opposite poles of mystic potency and uncleanness ; so that the very source of her earlier influence might, under altered circumstances, prove an occasion for multiplying her disabilities. Half-priestess and half-witch as she had always seemed to the mere male, he had to regard her chiefly in the latter light now that she stood no longer for social strength but rather for individual weakness. Thus if the moral position of women were to be made the sole criterion of social evolution, it might lead to some queer results.

It has been necessary, even at the risk of some very speculative reconstruction of the earliest history of the species, to bring out the contrast between mother-right and father-right in their most uncompromising forms, in order to illustrate the effect of a strongly developed kinship system on the moral relations of husband and wife. Before one looks into the facts it is all too easy to imagine that the early home consists of father, mother, and baby, and that by the time they are grandparents a nice little society has grown up with the original progenitor in command. In reality, however, it would seem that the individualization of the family, as a partnership involving common bed and board, is the outcome of a slow and tortuous process of evolution. So long as marrying out did not imply living out, love in absence had no chance of prevailing against the sympathy of close but non-conjugal cohabitation. The woman's part was in these circumstances to play the mother rather than the wife, and her real home was the women's camp where the women and younger children slept together apart from their elder sons and brothers ; and the women's camp, thus hedged off from male interference, would doubtless act solidly, as well as shrilly, together in support of the feminine point of view. In the same way the men would be organized on a sort of regimental plan, according to which authority must be mostly a matter of seniority ; so that between them the elder women and the elder men would take the lead as groups rather than as individuals. Moral relations would thus be felt less as inter-personal ties than as collective obligations. There would be plenty of loyalty but little love. The mutual attractions would be felt in and through concerted movements of a mobbish type, and sex and age between them would determine conduct almost regardless of private inclination or capacity. It remains, then, to review shortly the group-attitudes that resulted from a domestic life dominated by kin in the place of the individualized family.

First, then, as regards the relations between the sexes, enough has perhaps already been said to show that the intercourse between them, so far as they involved no conjugal familiarities, would tend to throw a glamour of mystery over the woman's side of life ; such as would at once protect women from male bullying, and give them authority, more especially as peace-makers. For the rest, their relative importance as a sex would depend largely on two things—the value of their contribution to the food-supply, and the extent to which they managed to keep their marriage-arrangements in their own hands, so that they chose their lovers and were not assigned to them to suit their brothers' convenience.

Next, as to the relation between children and their elders—whereas the girls would form a permanent part of the women's camp and be duly brought up in its ways, the boys, as soon as it was advisable to separate them from their sisters, would go off to sleep and live with the men. There is no reason to think that here they would not be kindly treated. The relation between a youth and his maternal uncle is always marked by a friendliness that is conspicuously absent from his more formal attitude to his father, so long as there is any question of a divided authority. Indeed, it has been already noted that the terrorism which marks an Australian initiation is accounted for largely by the fact that it is practised on the novice by the inter-marrying group and not by his own kinsmen.

In any case the boys act and suffer as a class, and the fact that they are doing exactly what their elders did before them makes the educational machine run smoothly. The age-grades succeed each other like the waves of the sea ; and at any time the strength of the group, reckoned in males, consists of three major categories—a promising crop of youngsters, a corps of trained hunters and warriors in their prime, and a body of elders sage in counsel and versed in luck-bringing ceremonies. All are equally necessary to one another, and the normal group is well aware of the fact. One must not make too much of the occasional cases of infanticide ; or, at the other end of the scale, of senicide, namely, the putting away of the old and feeble. Travellers of the baser sort are fond of adorning their pages with such horrors, but they accompany unusu conditions, namely, either a state of extreme privation, or one of dege erate slackness and irresponsibility. The typical savage takes the greate pride in the fecundity of his womenfolk ; and on the other hand is amenable to the authority of his seniors that gerontocracy, the rule the old, might fairly be said to be the earliest form of government. must be remembered, too, that the living regularly believe themselv to be in the closest communion with their dead ; so that the greybea on his way to become an ancestor has all the more power to bless or cur credited to him, as it were, by anticipation.

To sum up about the kin or food-group conceived as the earliest ty of social unit, it is not as my husband, my wife, my child, but as our m or women, young, middle-aged, or old, that one and all think of the selves in their most intimate relations with each other. To realize t collective personality appropriate to sex and age-grade is their only w of feeling, and being, at home. The moral law is summed up in the wo " Imitate." The harness of custom will hold so long as every rank in t linked procession conforms to the movements of the rank in front. T philosophy of " follow one's nose " will suffice if fortified by an occasio growl from the older and stronger when the rear ranks break step or l A communistic system depends for its success on the average perfor ance of the average man ; and it was within the compass of the avera intelligence to grasp that the primitive kin must not quarrel, mo especially over its own women, and that it must share its takings in t way of food fairly and squarely. As for the male duty of protecting t breeding mothers, that must be done vicariously as long as a man ate home but wived, and so all-unconsciously bred, abroad. So much, th for moral life within the home—the circle of immediate symbio Meanwhile, any kind of exogamy implies dealings with neighbou What, then, of moral relations with them ? On what minimum terms mutual forbearance or positive amity can an inter-marrying union social groups be established ?

(*b*) *Tribal Virtues*

The tribe comes gradually into existence because to shake one's c at the foreign male, and to make eyes at the foreign female, prove in long run to be incompatible proceedings. In proportion as marriage volves cohabitation between the parties, whether it is the husband or wife that plays helpmate to the other group, two domestic circles m intersect. Nor can it fail to strike them sooner or later that, so far as t can act conjointly in consequence of this intermixture, they are twice strong as against third parties. Before any such co-operation can occ however, they must be able to converse in something better than language of signs. Now we do actually hear of cases—one in point is t of the Carib invaders of the Lesser Antilles, who had killed off Arawak males and appropriated their womenfolk—in which the wi speak one language and their husbands another. In such circumstanc however, there might well happen what both African history and Gr legend show to be humanly possible, namely, that the mothers sho ing up their sons to slay their own fathers in revenge. Normally, wever, when the inter-marrying groups are on some sort of equality in wer, not to mention culture and race, they are bound to come to terms out their matrimonial cross-connexions. On the matrilocal system, the est toleration on the part of the woman's brethren towards her more less furtive lover will induce the latter to protract his stay ; and, once tled in the new camp, he will have to pay for his keep by making him-f useful.

A patrilocal system, on the other hand, will always be somewhat more ficult to establish, since it means some hard bargaining, prefaced it y be by not a little poaching, before the women can be parted from society of their mothers. Somehow, male dominance must have ched the point at which the united wishes—we had better say the ted curses—of the mothers have ceased to exert much practical ect. As for the hardship of being cut off from one's own people, that st depend on the extent to which the economic life favours close asso-tion between the separate food-groups. Even in the richer kind of ne-country hunters need a good deal of room ; while fishing tends to centrate round scattered spots on coast or river.

On the other hand, there will always occur seasons of plenty, or periods interrupted labour during which the people live on their stored pro-ons wherever shelter is best obtained, when the scattered bands can emble to hold high holiday together. We need to go back, however, the etymology of the word " holiday " to appreciate the taste of the age for collective ceremonies which stand with him for the highest ue that life affords. Even food is not so important in his eyes as the stic procedure whereby he seeks food and all other blessings at the ds of the unseen powers. For, however secondary its function when arded as a means to living, his religious life has come to stand prim-y and in itself for something more than living, namely good living. s common interest in sacred rites which gives all a sense of height-d being, in that it causes them to lift up their hearts together, is the f source of such moral sympathy as gradually grows up between them. firmest spiritual nexus of tribal life is a common worship.

hat economics will follow in the footsteps of religion is easy to see. so-called silent trade, when one party to the transaction nervously osits his object of barter on a prominent stone, and retires into the h until the other party has had time to remove it and substitute *quid pro quo*, is a tiresome mode of commerce. On the other d, a religious festival is at the same time a fair when, thanks to prevailing " truce of God," folk otherwise none too friendly can lge in the chaffering of the market without risk of coming to vs.

gain, law likewise waits on religion for its opportunity. The best way ttling a quarrel is, firstly, to get the disputants to meet and have it and, secondly, to bring this about in the presence of third parties, have no interest in the matter one way or the other, and do not want disturbed by feuds such as always tend to spread. Thus in Australia iting group is expected to come out on its first arrival with every-g unpleasant that it has to say about the conduct of its hosts, who are

equally outspoken in their recriminations ; the men shout and brand
their weapons, the women intervene, and, after much steam has be
blown off, all cheerfully assume their party-manners. Similarly,
occasions of tribal assembly more serious cases of trouble betwe
kins and local groups are disposed of by some kind of regulated fig
such as tends to become more and more symbolic, a mere vent
angry feelings ; as when the culprit is let off after he has stood up t
shower of spears or boomerangs, which he is usually quite competent
dodge.

All such association, then, under the stimulus and shelter of religi
clearly makes for peace ; and, even in a loosely aggregated society of se
independent groups, between which a certain amount of sneaking mur
persists on the score of blood-revenge, causes them in the long run to
tend the area of moral obligation from kin to tribe. The separate broth
hoods come to acknowledge a common cousinhood. Human society
reached the stage of the multi-cellular organism.

Now the savage doubtless always remains collectivist or group-c
scious in his moral outlook ; but at least he becomes aware, when
tribal spirit develops, of competing group-loyalties, of which the m
intense has the disadvantage of being likewise the narrower. Comn
customs, then, and more especially, as we have seen, common religi
customs, can do much to promote friendly relations. But something m
than a diffused friendliness is required to bring home to the moral c
sciousness the subordination of kin to tribe as part to whole. Defi
organization of a centralized type must be somehow evolved. In a wo
group-regimentation implies an overhead rule.

Thus tribalism thrives on war. In North America we find the v
word for tribe meaning those who fight together. War, however, has it
to develop from the loose skirmish to the serried order of battle, and
authority of the war-chief will vary accordingly. His best chance i
combine executive strength with religious prestige ; and the two tend
go together, since success and *mana* are for the savage almost convert
terms. War in its turn leads to conquest, and at this point tribalism, wh
is essentially a system of co-ordinated groups, passes into State-organ
tion or polity involving some sort of class system. At its crudest the c
querors form a governing caste, while the conquered are little better t
slaves or serfs. Unless inter-marriage is prohibited, however, between
upper and lower orders, an aristocracy of status will gradually be repla
by one of merit. For the rest, the rule of the stronger will assume the c
of a superior sanctity, and custom will confer a consecration on the
tablished regime. Morally dubious, however, as such beginnings
seem to us, let it not be forgotten that our civilization is their ultin
outcome, and that we have in the course of the process become ever n
conscious of common interests, and of a common duty to promote t
realization.

(c) *Inter-tribal Virtues*

Whereas savagery scarcely extends beyond the limits of tribalism, w
on the contrary it may barely attain them, it must not be supposed
at this level of society the foreigner is regarded as a pure enemy, a b

hout moral rights of any kind. Undoubtedly, in the early world, it is
only sound policy to bristle up on the approach of the strange dog.
t his very strangeness is a protection to him, investing him with *mana*,
ower to bless and to curse. It is quite a chance which aspect of him will
vail. Either he will be slain offhand ; or else he will be hospitably en-
ated, so that he is made free of board and, in the fullest sense, of bed as
l. In Australia, for instance, a native will make long journeys into
eign parts, not without risk of sudden death it is true, but in the main
ely, and on such terms that, as Lord Avebury puts it, he finds himself
itled to " a thousand miles of wives." When he turns up among a
nge group, he will be closely questioned as to his identity, and must
lain it in such totemic terms as the others can appreciate. Failing to do
, he will probably be speared ; but as soon as he has made good his
ting he is welcome, and, if he has a new corroboree tune or step to
art to them, so much the better. In this way customs spread, and com-
n culture makes for common understanding. Indeed, inter-tribal mar-
es are fairly frequent, and the subsequent initiation ceremonies,
en the education of the future husbands is entrusted to the group from
ch the wives are to come, gather the folk together on a scale that might
ermed incipiently national.

t is a long way further, however, in the scale of social development
en, as in North America, a group of fighting tribes find it convenient
rame a pact whereby the entire confederation, so long as it is unani-
ıs, makes war or peace together. Commerce, again, breaks down the
iers between alien peoples, and the trading voyages of the Pacific re-
are peacemaking in their effects, so long as the navigators do not find
cy and head-hunting more satisfying to the adventurous spirit. Mean-
e, movements of population due to various causes, mainly economic,
urb the social balance, beginning in clashes but usually ending in some
of amalgamation ; so that the world grows ever more mixed alike in
and in culture. To this larger world the moral consciousness becomes
ly adapted ; though, if we are to-day more humanitarian than the
ge in theory, our practice may still leave something to be desired.

(2) *Activities making for Personality*

Virtues constituting Manliness

has already been pointed out that, just as there are no instincts that
not the good of the race for their ultimate biological purpose, so
are no virtues that are strictly self-regarding ; since, in so far as they
ster to our moral individuality, they are at the same time helping to
us more useful to our neighbours. On the other hand, even in the
communistic of primitive societies everyone must, as a matter of
nterest, mind his manners, lest he or she fall too conspicuously be-
he general standard of respectability ; for that way lies suffering,
sudden death as its downward limit. Even if the kin-group is lenient
rds its feebler folk, these must approve themselves fit before another
is likely to allow them to mate with any of its members. Thus, al-
gh moral competition does not take the form of striking out in new

directions, there need not be any corresponding lack of individual ente
prise as regards excelling in all customary pursuits.

In a word, the ambition of every savage is to live up to the fashion.
has already been said, he is not without a desire for self-realization, b
it is an exterior self that he has mainly in view. By a sort of imitati
turned inwards he identifies himself with a copy of what the best peop
do, and then tries to copy this ideal copy as faithfully as he can. If he c
in imagination see himself making a good show, he is satisfied. Let hi
on the other hand " lose face," and his self-respect is gone. He cann
stand up to an adverse public opinion. Nothing is so galling to him
ridicule, however ill-deserved. He must always be on his dignity, a
nothing is easier than to offend him by demeaning him in the eyes of
fellows. Half his troubles with the white man are due to more or less u
witting breaches of etiquette on the part of the latter, whose most radi
mistake is to forget that the savage is a gentleman, and as such decide
nice on a point of ceremony or honour.

Given, however, a sympathetic audience, no one is more ready to p
the man ; while, within her more limited circle, the same applies to
woman. We have only to think of the fortitude displayed by the Ameri
brave under torture. As sheer drama it is superb. Ringed round with
enemies, he will force them to admire him ; and, since their moral sta
ards agree with his, he doubtless succeeds in doing so. Now a self-este
so closely allied to self-display has obviously its petty as well as its nob
side. It may produce the coxcomb as readily as the hero ; many a sav
warrior, in truth, being an odd mixture of the two, while as for pain,
wounds received in battle may well have cost him less than those incid
tal to his toilette. On the whole, however, we may say that this anxi
to shine keeps the average individual up to the mark alike in the essent
and unessentials of current conduct, so long as the social system is inta
whereas, if the cross-imitations are interrupted, the morals br
down.

For the rest, a responsiveness to the social drill being more passive
less voluntary than a true self-control, which involves assent to an in
ligible principle, the repression entailed is greater. Hence savage mora
is apt to present the contradiction of a rigorism tempered by o
Periodically custom allows the savage to let himself go, usually on so
religious excuse, and for the time being he seems to part company
all his moral rules. The false notion that this in his normal condition,
stead of an occasional remedy designed, as they say in Ashanti, " to m
the heart cool," is responsible for many an undeserved libel on
general character of worthy folk, who despite such outbreaks are for
most part steady-going in the extreme, as the stability of their inst
tions proves. We must blame the custom rather than the individual
in order to do the correct thing, he must at stated intervals behav
though temporarily intoxicated or downright insane. The same pe
can, when occasion demands, throw himself with equal abandon
duties that tax his powers of self-sacrifice to the utmost, more especi
if a certain magnificence of gesture, as for instance in the way of reck
courage or equally reckless liberality, is thereby achieved. Making all
ance, then, for the ready-made cut of his moral garb, we can see that

proper man who wears it. Under civilization each of us has a far better
ance of securing a fit ; but even so the happy mean between uniform
d fancy dress is none too easily attained.

Virtues constituting Godliness

It remains to consider the effects of primitive religion on the inner life
far as these make for an increase of moral individuality, that is, of the
wer to choose, initiate and direct in all that relates to the good life.
er and above such manliness as can be fostered in ordinary folk, there
needed the supermanliness of those rarer spirits whose function it is to
d the rest. In the eyes of the savage such men stand nearer to the gods,
actually rank as gods. Hence godliness is no bad word to express the
perior degree of enlightenment and driving force manifested in those
ose natural gifts, fortified by a suitable education, mark them out for
sitions of social authority, with a social responsibility thereto attaching
strict proportion. One must not, of course, exaggerate into a difference
kind what is but a difference in the degree of realizable capacity as be-
een one man and another. Yet it is plain that, so long as biological de-
tions from the average occur, it must profit a human society to utilize
se conducive to its more intelligent management.

At the same time, social sympathy would seem to rest chiefly on the
cognition of an equality of need rather than on that of an inequality of
rit. If a human group is to remain morally at one, it will not do to em-
asize the dependence of one part on another, but on the contrary to
ke the most of the common dependence of each on the rest. It is bad
e for inferiors and superiors to regard themselves severally as such ;
t one and all can afford to translate the superiority implied in leadership
o something relative to the general good, namely an opportunity and
all for fuller service. The " super " of the superman may thus be, as it
re, detached from him and represented as a capital value which really
ongs to all, though lent to him on trust. It would be a fatal policy to
el down all talents to the minimum, or even the average, ratio of
ciency ; but to level them up by recognizing a transcendent or divine
ndard, to which even the best men with all their efforts can but im-
fectly attain, is bound to bring out all the power that a lofty aspiration
excite in human nature. Religion, together with morality and educa-
, must always support a doctrine of aristocracy ; yet it must do this in
junction with a doctrine of humility that proclaims a sense of infinite
rtcoming to be the secret of all striving after the ideal, and makes this
ne discontent with self the final test of human nobility.

Now primitive godliness is, from a civilized point of view, a very
btful type of virtue, and if its moral value is to be justified it will be
essary to examine it at some length. The manly savage, indeed, we
e not great difficulty in understanding, even if he sometimes seems to
o go to the wolf for his model of what a man should be. But we are
picious of the man-god. Indeed, none of his modern analogies, con-
ated king or infallible pope, canonized saint or inspired poet, can be
to enjoy an authority that is divine beyond all dispute. On the other
d, when biology puts forward a theory—of course it does not pretend
e an ultimate explanation—of genius as a happy combination of

unusually potent genes,[1] it does nothing to show why, and in what form society ought to utilize and respect it. A moral philosophy, then, needs think of outstanding human goodness in some way better suited to its ov purposes. Hence, so far as the savage can be credited with a conscio doctrine on the subject, its main tenets may turn out to be less inadequa than might at first sight be supposed. For the belief in *mana* more or le explicitly involves two assumptions : firstly, that all good *mana* is a g to a favoured few who must show themselves worthy of it ; secondly, th it is meant to be used for the benefit of all.

Thus, on the one hand, the possession of *mana* is held to be conditio on the observance of taboo. Wonder-working is incompatible with se indulgence ; nay, to be truly great a man needs to cut himself off from t interests and pleasures of ordinary life—must “ scorn delights and li laborious days.” Not only is he bound to face the stern discipline in dental to initiation, but he needs to maintain his austerities througho life, lest his indwelling power should depart and leave him an emp vessel. If he is to inspire others with a faith in his helpfulness, he mu first possess faith in himself ; for the impotence of the charlatan is pr portionate to his want of self-respect. At all levels of society, includi that of savagery, there are hypocrites whose sanctity is but an offic smugness which they sport like a mask ; yet these count for very lit beside the genuine leaders, in whom a certain honesty of purpose mu always prove the secret of their strength.

Again, on the other hand, good *mana* is known by its fruits. An an social wonder-working is rated as black magic, and plain men see to that the sorcerer dies the death. No doubt the use of good *mana* inclu a power to punish with curse or excommunication, but this is stric limited by the public interest, being simply a way of calling down t justice of heaven upon the backslider who is at once criminal and sinn Indeed, the principle of the responsibility of leaders is so well recogniz in the primitive world as even to be overdone. That one by his own fau such as neglect of his taboos, should be forcibly deprived of his positi of authority, is reasonable ; but it is hardly so reasonable that sickness old age should condemn the worthy ruler to an abrupt and violent e Yet such a doom is often allotted by custom to the savage potentate w in the heyday of his powers, has been accounted to sway the very u verse, to make the sun to shine and the rain to fall, for the benefit of subjects. One of the many paradoxes of human religion is the view tha is possible to propitiate and honour a god by slaying him in another his aspects. The primitive king, moreover, takes up office with a knowledge of the conditions under which he must lay it down, and is th in a sense a willing victim—one who identifies his sacred mission with very life, and is prepared to revitalize with his own blood that power superhuman guidance which must never grow feebler if the commun is to last. On the other hand, such a death is regarded by all concerned a translation to a sphere of greater majesty conjoined with usefulness ; the tomb of the departed monarch becomes a shrine, his relics are p lific in miracles, and his ghost is uplifted to rank among the gods a source of blessing to all future generations of his people. Even so, s ıblic divinity is only to be purchased by private suffering. Indeed, a gime of custom, as compared with one in which the individual is more ee to choose, possibly offers fewer opportunities of evading the funda- ental law of society that greater privilege stands for harder service.

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[1] See the Article on *Biology and Human Progress*, p. 238.

It would be an endless task to consider in detail the many types of ıding men whose social position carries with it a more or less sacred aracter, with a corresponding obligation to behave in a strict and cir- mspect way. From a modern point of view, we might be tempted to ssify them according to their functions as lay or religious, chief or ctor ; whereas really one and all in their own eyes are wielding a power ich, whether inherent in their office or derived from ceremonies, is nething, as it were, superadded to their ordinary personality, a com- ınication of energy from a source lying beyond the range of common perience and unexplainable in terms of common sense. It is not, of ırse, as if none but a great man had any chance of access to such a gher plane. In the first place, all the public rites of the community ve the same end in view, namely, that of tapping some sort of super- tural grace. In the next place, the meanest individual can expect his le share of *mana*—a slice of luck, a touch of inspiration. Yet, on the ıole, it is reserved for the man of light and leading to play the part of ermediary between the people and their gods ; and it is on such a eoretical basis that primitive government implicitly rests, being always the broadest sense of the term a theocracy.

The anthropologist has to recognize that there are many possible ways symbolizing the divine ; but, however it is figured and explained, ether under an impersonal and quasi-material or under a personal l quasi-human form, it is universally believed to stand for all that man nature longs to enjoy more fully than it has yet—strength, wisdom, ppiness, duration of days. At the same time the savage world at large ılso conscious of something antithetic to the divine—another set of uences that conspire to encompass life with horrors and drag it down ɔ death. Balancing uncertainly between these opposite stresses of reme hope and supreme fear, the majority in times of peril turn to few who can deal boldly with the critical situation. When the crowd ics, those in charge of the emergency exits must not lose their heads. such circumstances the leader is called upon to show more confidence n perhaps he feels ; and it is not only the bad doctor who tries to look er than he is. Hence it would be unfair to judge the man who is ıted to cast out disease-devils as a solemn humbug, because he some- es seems to descend to conjuring tricks, as when an Australian licine-man pretends to suck out magic crystals from the body of his ent. It is a professional gesture that is in strict keeping with the cial tradition, and is adopted, without any sense of guile, as part of a tment designed to carry conviction on the face of it. Indeed, in order be popular all authority must somehow manage to be impressive ; ıuse simple folk believe mainly through their eyes. On the other hand, rder to appreciate the man who stands out among savages as of erior character and ability, we must endeavour to project ourselves his inner life, so as to discover what kind of disposition it is that lers him so strong and efficient. Moreover, we may be sure that he has not got what Plato would call " the lie in the soul," but on the contrar is upheld by a sense of being in touch with some higher reality. On it intellectual side this experience of *mana* is hard for us to interpre because primitive theology is a mass of obscurities and contradiction Morally, however, it likewise involves emotional conditions that we ca appreciate better, since they reflect far more clearly than any play o ideas the common and abiding tendencies of human nature.

Rites may be divided roughly into negative and positive, according a their main purpose is either to keep away curses or to attract blessing The evil avoided or the good sought is always of a mystic kind, that is t say, is held to transcend the ordinary alike in its causes and its effect Hence, being such as to stir the mind to its very depths with transport of dread foreboding or else of exaltation, the experience in question tend to acquire more significance on its moral than on its material side ; s that the fears and hopes of the religious man come to be largely concerned with accursedness and blessedness, more or less clearly conceive as states of the soul.

Thus, to deal first with the subject of negative rites or taboos, a typic way of representing their object is to think of it as the avoidance o uncleanness. It is a spiritual uncleanness that is meant, though savag religion—and advanced religion is ever liable to the same fallacy—is ap to fall back on the literal sense of its symbolic act, so that, for instanc a savage will indulge in an endless number of lustral baths, or scour h inside with purges and emetics, in order to get rid of the sin for whic the very name that he commonly uses means " dirt." Another difficult of rudimentary religion is to distinguish between a moral and a merel ritual purity. Many taboos would seem to have begun as almost irration phobias[1]—for instance, the fear of contact with woman's blood. Thus is but gradually that round such casual centres of primitive attentio there gather all sorts of vitally important obligations ; as, for exampl the laws against incest and the murder of kindred may well have develope out of some such quasi-physical repulsion. Indeed, the path of the stri observer of tradition is beset with so many pitfalls, a devil lurking at th bottom of every one, that he may be excused if he is more immediate occupied with walking warily than with attending to the precise directio in which he is going.

Nevertheless, the mere act of restraining oneself from oversteppin the bounds is not destitute of positive benefit. To practise chastity, fo instance, may begin as a ritual precaution, but the self-control therefro resulting is a spiritual asset, in that it promotes the sublimation of sexu desire[2] as well as otherwise assisting to discipline the character. Th same growth of moral value can be noted in the case of fasting, or that of the sacrifice of property. At first these are repressions of norm instinct induced by almost meaningless fears, causing good food to b treated as if it were poison, and useful objects to be thrown away as they were infected with disease. Yet to endure such deprivations is goo for the soul in the long run, not exactly for its own sake, but because

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[1] See the Article on *Psychology*, p. 345.

[2] For an account of the process of sublimation, see the Article on *Psych* *Analysis*, pp. 372 and 375.

fords preliminary practice in bringing the will to heel and using it as
e ally of reason in the work of shepherding the passions. Hence, to be
ire and to be strong in heart ultimately go together ; and thus not only
gatively, but quasi-positively, his taboos afford the savage a lesson in
dliness by exhibiting it as the moral opposite of all such spiritual
ngers and temptations as are most damning, that is, deadly.

Turning to positive rites, we perceive their general import to be the
curing of mystic blessings ; which in turn, as having the transcendent
d infinite quality that belongs to the supernatural, come to be chiefly
visaged as an enlargement and uplifting of the spirit. Here, again, the
age tends to confuse the ritualistic with the moral effect, so that the
e itself seems as it were automatically to communicate the grace. Thus
rimitive act of religion is, on a short-sighted view, easily mistaken for
ort of pseudo-scientific operation ; and the civilized observer contemp-
ously notes how the unpractical savage goes on cheerfully performing
surd experiments, the outcome of which is *nil*. It may strike a more
netrating mind, however, as a little remarkable that the world should
ve persisted through such long ages in taking all this trouble for
thing. It is true that men have always prayed to the gods for their
ily bread and all other material kinds of prosperity ; but this is but
t of a larger hope that embraces all good living ; which in turn really
ounts to the inward experience that it is good to be thoroughly alive.
es, duly carried out after a preparation conditioned by taboo, are
nd to yield *mana*. Having suppressed the flesh, the godly man finds
t he has liberated the spirit. He has acquired a fresh self, and one with
ich it is more encouraging and altogether more satisfactory to dwell.
en aboriginal Australia can talk, like Dante, of a " new life," such as
nes with and through the puberty rites, and is experienced in even
ler forms in the progressive initiations to which the adult is subject.
he primitive theologian be asked whence the *mana* comes, his answer
alting and mixed ; but he knows *that* it comes, while his ritualistic
dition also tells him how it is acquired. His religious experiments, it
rue, may not always succeed ; for often he over-excites himself, and
erates a sort of temporary madness. On the whole, however, the god-
ss of the savage may be reckoned the chief source of the morale that
slowly but surely raised humanity from the purely animal level to a
lized condition.

CONCLUSION

he anthropologist is a man of science, and is therefore not called upon
lay the philosopher and interpret human history from the standpoint
he ideal—a precarious task, since the philosopher is a man like the
of us, and has to construct his notion of the ideal and perfect out of
nents which are tentatively selected from the actual and imperfect.
ertheless, to consider ourselves in the light of what we may reasonably
e to become is our first and last duty as self-directing beings. Strictly
ordinate to this end is, therefore, the function of a Science of Man
ch provides a preliminary statement as to where we are at present,
how we got there. Such a science, keeping clear as it tries to do of
theory of ultimate value, is not strictly qualified to affirm the reality

of human progress at all. After a fashion, however, and without prejud to the final verdict of philosophy, it can do this by observing the resu of Man's competition with the other related forms of life. Indeed, far as knowledge of fact can take us, we are on firmer ground when take stock of ourselves as evolved animals than as undeveloped ange Thus, in a quantitative way, we can attest the increased dominance our species by reference to the growth of population and the grea average duration of life. A qualitative criterion, however, could alo serve to justify the philosopher in claiming, as against the dismal assum tion of cosmic indifference, that this long historical process stands the gradual unfolding of an immanent good. He must be able to sh that through the ages mankind has advanced from a less to a more sat fying kind of experience—that the meaning of life has been someh enriched. Can any such conclusion, then, be gathered from the foregoi account of savage morality? What, perhaps, comes out most clea from such a bare sketch of the main facts, is the preoccupation of primitive mind with brave dreams that, however fantastic in themselv react on it to stimulate desire and to enlarge hope. As far back as we c trace him, Man appears as a visionary who has lived on an overdr and traded on credit. Since, therefore, something infinite attaching to notion of good has hitherto helped him on his way, it might well se sound policy on his part to continue steadfastly to imagine the divi and to treat it as the only true measure of the human.

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GLOSSARY TO TEXT

Totemism, as applying to the clan, is the system whereby a subdivision a tribe identifies itself with an animal—or plant—species, using name and claiming to be in mystic touch with it.

Mother-right stands for kinship as traced through the mother, be matrilineal in so far as the children derive their family name from h matrilocal so far as they are brought up in her home and among people, and matripotestal so far as they are under the legal control her people and herself. Father-right implies the opposite of th conditions.

THE CHARACTERISTICS AND DISTRIBUTION OF THE HUMAN RACE: N INTRODUCTION TO ETHNOLOGY

By

C. G. SELIGMAN

SYNOPSIS

me and Space. Early forms of man, their antiquity and distribu-
n ; the " missing link " — Criteria of race ; blood groups —
mperament and character.

ces of Man. The six great divisions of mankind, their distribution
1 physical characters.

rope. Antiquity of man in Europe — Mediterranean, Alpine, and
rdic races ; their contrasting temperaments — The Turki peoples
Europe — The Basques.

ia. Early man in Asia — Ethnic confusion in the Near East — The
stern Turki peoples — Medes and Persians — Arabia, the home of
Semites — Palæo- and Neo-Siberians, reindeer pastoralists of the
ndra and Tayga — The Japanese ; importance of Ainu influence —
ina ; early civilisations ; contrast between northern and southern
inese — The Moslems and Jews of China — Tibet — Mongols
Manchu — French Indo-China ; the " southern aborigines " —
lays — India ; Pre-Dravidian jungle tribes ; Risley's classification ;
caste system.

ica. Main ethnic divisions — Hamites, Negroes and Bushmen —
pre-dynastic Egyptians and their modern representatives — The
b invasions — Antiquity of the Negro in Africa — The true
gro ; the Negro-Hamitic peoples and their chief divisions, half-
nites, Nilotes and Bantu — Negrito and Bushman — Hottentots
ndonesian influence in Madagascar.

erica. Physical characters of population ; similarity of type, point-
to original common Asiatic parentage — Linguistic considerations
Culture of early immigrants — Food areas and cultural groupings
he Eskimo — Ancient civilisations of Maya and Aztec — The
bcha and Inca — Savage tribes of South America.

ania. Australia and the island groups of the Pacific — Australoid
l skulls in Java and Queensland — Migrations of Polynesians
Indonesia to the Eastern Pacific — Physical characters of Poly-
ans and Melanesians — Micronesia.

THE CHARACTERISTICS AND DISTRIBUTION OF THE HUMAN RACE

AN INTRODUCTION TO ETHNOLOG

INTRODUCTION

Time and Space

In this Article we shall limit ourselves to the existing species of ma
Homo sapiens, to which all the living races of mankind are conventiona
referred. Moreover we shall consider only those forms of man that ex
at the present time or have existed in the recent (holocene) period
which we live, and even here we shall confine ourselves to living peopl
referring only occasionally to the neolithic period and ignoring the earl
representatives of *Homo sapiens*—men of the Aurignacian, Solutrean a
Magdalenian periods, *i.e.* of the latter half of the Old Stone Age—as w
as their epipalæolithic (mesolithic) successors, transitional to the N
Stone Age.

Yet, in order to have a background for our living races, it is necessa
to make mention, however bare, of the older species of mankind whi
furnish the most important fossils of the palæolithic age. Fig. 1 (aft
Elliot Smith) represents the relative position of the more importa
species and genera of extinct man in relation to the races of the prese
day. It will be noted that none of these early men stand in the dire
line of ascent of modern man ; we have in fact to give up the tradition
idea of the “ missing link.” There is indeed no single missing link joini
us to the apes, but innumerable forms bringing us nearer as we go ba
in time to the common anthropoid ancestor. “ In our first youthf
burst of Darwinianism we pictured our evolution as a simple processi
of forms leading from ape to man. Each age, as it passed, transformed t
men of the time one stage nearer to us—one more distant from the ap
The true picture is very different. We have to conceive an ancient wo
in which the family of mankind was broken up into narrow groups
genera, each genus again divided into a number of species—much as
see in the monkey or ape world of to-day. Then out of that great wel
of forms one species became the dominant form, and ultimately the s
surviving one—the species represented by the modern races of mankind.

It is perhaps worth noting that of the older forms Piltdown m
(*Eoanthropus Dawsoni*) is a relatively large-brained type with a low
jaw resembling that of a chimpanzee—in fact the jaw was at first held
many to be that of a chimpanzee accidentally associated with fragme
of a human cranium—while the recently discovered remains of Peki
man (*Sinanthropus pekingensis*) is of the low heavy-skulled type, with
great bar of bone running across the forehead above the orbits, but w

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[1] A. Keith : *The Antiquity of Man* (1915).

w clearly related in form to that of Piltdown man. Nothing is gained endeavouring to estimate the duration of the palæolithic in terms of rs, but we may agree that the trend of modern research is to place end in Europe some eight or ten thousand years ago, while the imagiion best deals with its earlier phases in terms of changes of geography, na and flora; thus England, Ireland, and the continent were one, re was no English Channel, and a greater Rhine, with the Thames

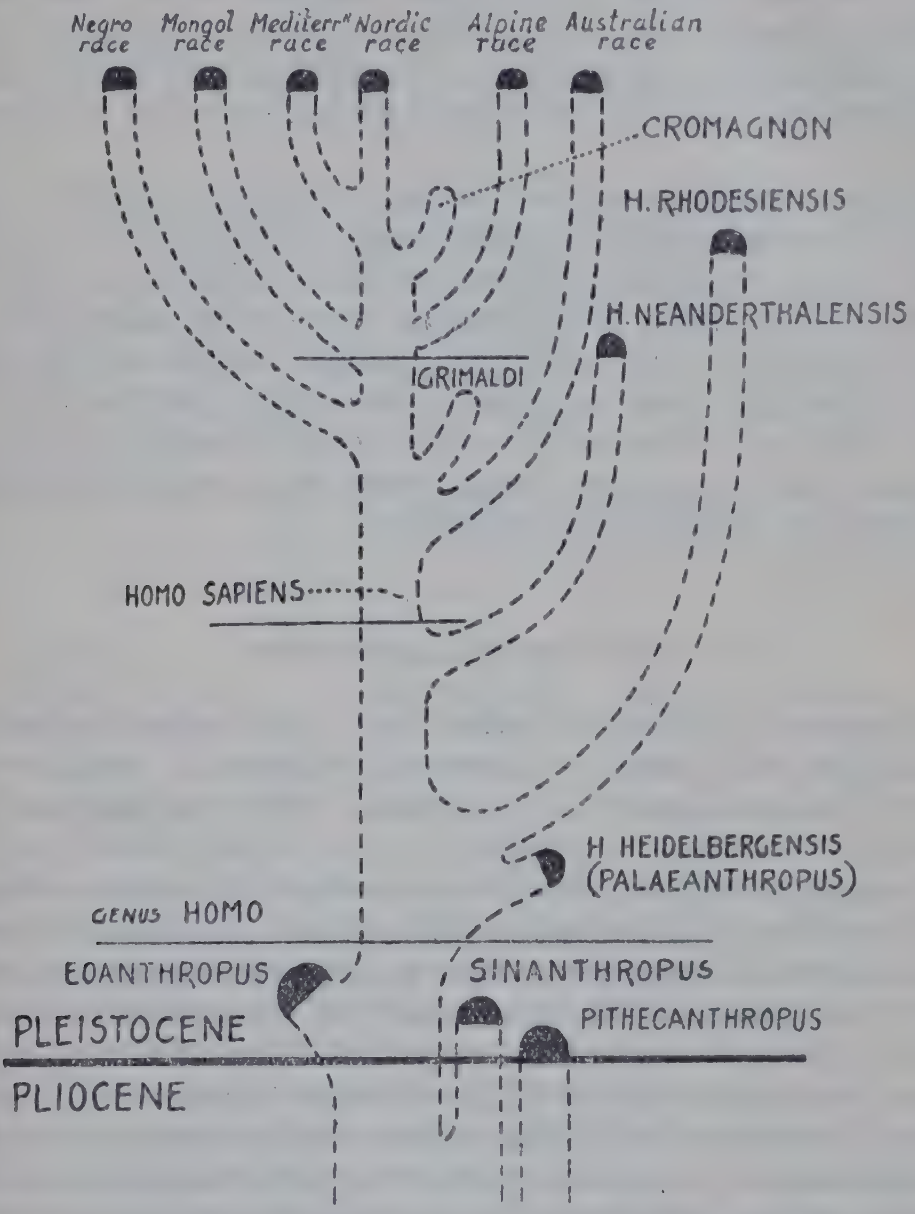

Fig. 1.—SCHEME SHOWING POSSIBLE RELATIONSHIP OF VARIOUS FORMS OF MAN

ffluent, opened into the Arctic Ocean somewhere in the neighhood of Iceland.

egarding the place of origin of man, we can only say that "somee in Asia" is regarded as the most probable; while as to the causes ifferentiation of the main races of mankind, the only suggestion ng even *prima facie* plausibility is that put forward by Keith, who ds the outstanding racial differences as directly due to qualitative quantitative variations in the secretions of such glands of internal tion as the thyroid, pituitary, etc. How far this fascinating hypo- is true only the future can show.

Considering area in relation to time, *i.e.* the filling up of the world, we accept Asia (whether East-Central or South-Western) as the crac of mankind, it is worth noting that such early forms as Heidelberg a Piltdown man had reached Western Europe at the Chellean period—t dawn of the pleistocene, the recent or quaternary period of the geologi —while there is steadily accumulating evidence in the West of mar handiwork at an even earlier period, though no actual remains of tertia man have yet been found. At the other extreme of the time scale, substantiated trace of palæolithic man has yet been found in the N World, indeed all the evidence goes to prove that both North and Sou America have been peopled exclusively by our own race of man, *Ho sapiens*.

Here it is convenient to define two terms which we shall have occasi to use, *viz*. palæanthropic and neanthropic. The former is applied all forms of man other than our own, the latter includes the many stoc of our species. In time, palæanthropic man as we know him at t moment is mainly of the Lower and Middle Palæolithic, but the d covery of Rhodesian man, an archaic form which persisted until a f thousand years ago, indicates how rapidly our knowledge may chan Neanthropic man appears in Europe with the Aurignacian period, at the beginning of the Upper Palæolithic.

The Basis of Classification

In attempting to define the term "race" we cannot do better th follow Haddon, who uses it to connote "a group of people who ha certain well-marked features in common,"[1] with the addition that t group should be as large as possible, *e.g.* we do not speak of a Swedi race, although typically the Swedes as a group have certain well-mark physical characters, but we regard them as one of the chief constitue peoples of that much larger group having these same characters, which call the Nordic race. While the number of characters that are to taken into account is largely a matter of individual opinion—in the p there have been many systems of classification proposed—it is genera agreed that character of hair, skin, colour, stature, shape of head, sha of face and shape of nose, are among the outstanding criteria of ra with quality of hair as perhaps the most important, and it is these t we shall use in this Article.

These criteria are in the main empirical, only doubtfully to be rela with environmental conditions. Thus, although it is true that the Ne race is confined to the tropics, and that in India skin colour is predo nantly dark, it cannot be said that all or nearly all inhabitants of torrid zone are dark skinned, witness Arabs and millions of south Chinese, nor can more than a tentative case be made out for the asso tion of a high nasal index with tropical conditions.

We may add that, apart from inter-breeding, the common criteria

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[1] A. C. Haddon: *The Races of Man* (1924). The author takes this opp tunity of stating his indebtedness to this invaluable small book, and a though, to a less extent, to A. H. Keane: *Man, Past and Present* (1920).

:e are of extreme stability, and that if there ever was a time of consider-le "plasticity" this is long past.

The criteria most generally useful are as follows :—

Hair:—This is generally recognised as of three qualities, *i.e.* traight," "smooth, wavy or curly," and "woolly."

Colour:—Skin colour is more important than hair and eye colour, ugh dark skin and dark hair commonly go together while the corre-ion of hair and eye colour is by no means so close, *e.g.* in Cornwall and in Brittany there is a dark-complexioned dark-haired light-eyed type great physical attractiveness. As already stated, dark-skinned peoples generally found in or near the tropics. On the other hand, there are a mber of peoples living in the torrid zone who are true "Caucasians," onging to the Mediterranean race, and such peoples (apart from sun-rn and dirt) usually have relatively light-coloured skins, though these neat coloured to light brown, with perhaps a tinge of copper) are con-erably darker than those of Europeans. The Hamites, especially the thern Beja (p. 467) of the Red Sea Province of the Anglo-Egyptian dan, are a good example of such "dark" or Allophyllian Whites, as xley called them.

Stature:—Here it is well to be precise : following Haddon, the terms hort," "tall," etc., will be used, wherever measurements are available, accordance with the following table, stature being given in inches.

Pygmy	.. ..	−58¼ in.	(−1.48 m.)
Short	.. ..	58¼–62¼ in.	(1.48 m.–1.58 m.)
Medium	.. ..	62¼–66 in.	(1.58 m.–1.68 m.)
Tall	.. ..	66–67¾ in.	(1.68 m.–1.72 m.)
Very tall	.. ..	67¾ in. +	(1.72 m. +)

'hat there is a considerable range of stature in most peoples is obvious, here, as in other measurements, averages of groups of thirty or forty ividuals come remarkably true ; moreover a tall race will not (apart n dwarfs) contain very short individuals nor a pygmy race tall men.

'ead-shape:—Looked at from the side some heads will be seen to be , others short (the hair must be discounted), while seen from above n heads look long and (more or less) round respectively. The various rees of this distinction in shape are expressed by the Cephalic Index ng) or Cranial Index (skull), which is the ratio (or percentage) of the dth of the head or skull to the length, the latter being taken at 100, C.I. = $\frac{B \times 100}{L}$. Except in artificially deformed heads it is uncom- for this figure not to fall between 65 and 90, and the vast majority between 70 and 85. The terminology commonly applied to this index ll) is :

−75, long or dolichocephalic.
75–80, mesaticephalic.
80 +, round, or brachycephalic.

difference of the index taken on the living and on the skull is about units, hence the cephalic index can be converted into the cranial by the subtraction of 2, and vice versa.

Character of face, prognathism:—Though a number of indices are common use for the face, it does not seem necessary to discuss them this Article. We are so accustomed to looking at faces that the ter “ broad-faced,” “ long-faced,” are self-explanatory, while all must h noted the varying projection of the forehead and cheek-bones (ma bones). Projection of the lower part of the face, especially of the low jaw (prognathism), is common in Africa, and where it is extreme th may be definite “ snoutiness.” This is generally, and no doubt correc regarded as a “ low ” character, its opposite, “ orthognathism,” especia when allied with a prominent forehead, being considered “ high ” fr the intellectual standpoint. But it should be noted that many Negr have bulbous foreheads without being particularly intellectual, while least developed races, with infantilistic crania, such as the Bushmen, n be relatively orthognathous.

Nose:—The nose may be long or short, broad or narrow, with its bric flat, medium, or projecting. The relation of length to breadth is so i portant that it seems well to give the terms and figures commonly e ployed, and since there is no morphological identity of the nasal indi taken on the living and the skull, and no easy mode of conversion of c to the other, only the figures for the living are given. The index is ag $\frac{B \times 100}{L}$, and the terms applied are :—

55–70 leptorrhine.
71–85 mesorrhine.
86–100 platyrrhine.

Noses that are broader than they are long (hyperplatyrrhine) are not v uncommon among Negroes. This index has proved of special use in ar in which the population is of mixed origin, *e.g.* in India it has be claimed that nasal index is an adequate guide to social status. The dev opment of the root of the nose is important (low, medium, high), as w as certain forms of the nose. Here most of the terms are self-explanato but it should be noted that the so-called “ Jewish ” nose, though of called “ Semitic,” is not truly so, since the purest Semites have it n it is characteristic of the ancient Hittites and their modern represen tives the Armenians ; it should be called “ Armenoid,” and where pres in a typical form may fairly be taken to indicate the admixture of menoid blood.[1]

Lest it be thought that undue space has been devoted to very comm place definitions, it may be stated that experience extending over m years has shown the absolute necessity, when writing for lay readers be extremely precise in definition if they are to grasp without innum able photographs the significance of physical characters. Moreov distribution maps of the various physical characters—stature, ceph index, etc.—such as those given by Ripley[2]—should be studied whene possible (*see Fig.* 2).

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[1] These definitions and remarks have been taken from the author's w *The Races of Africa* (1930).

[2] W. Z. Ripley: *The Races of Europe* (1910), with excellent maps of cephalic index, stature, and complexion, in Europe.

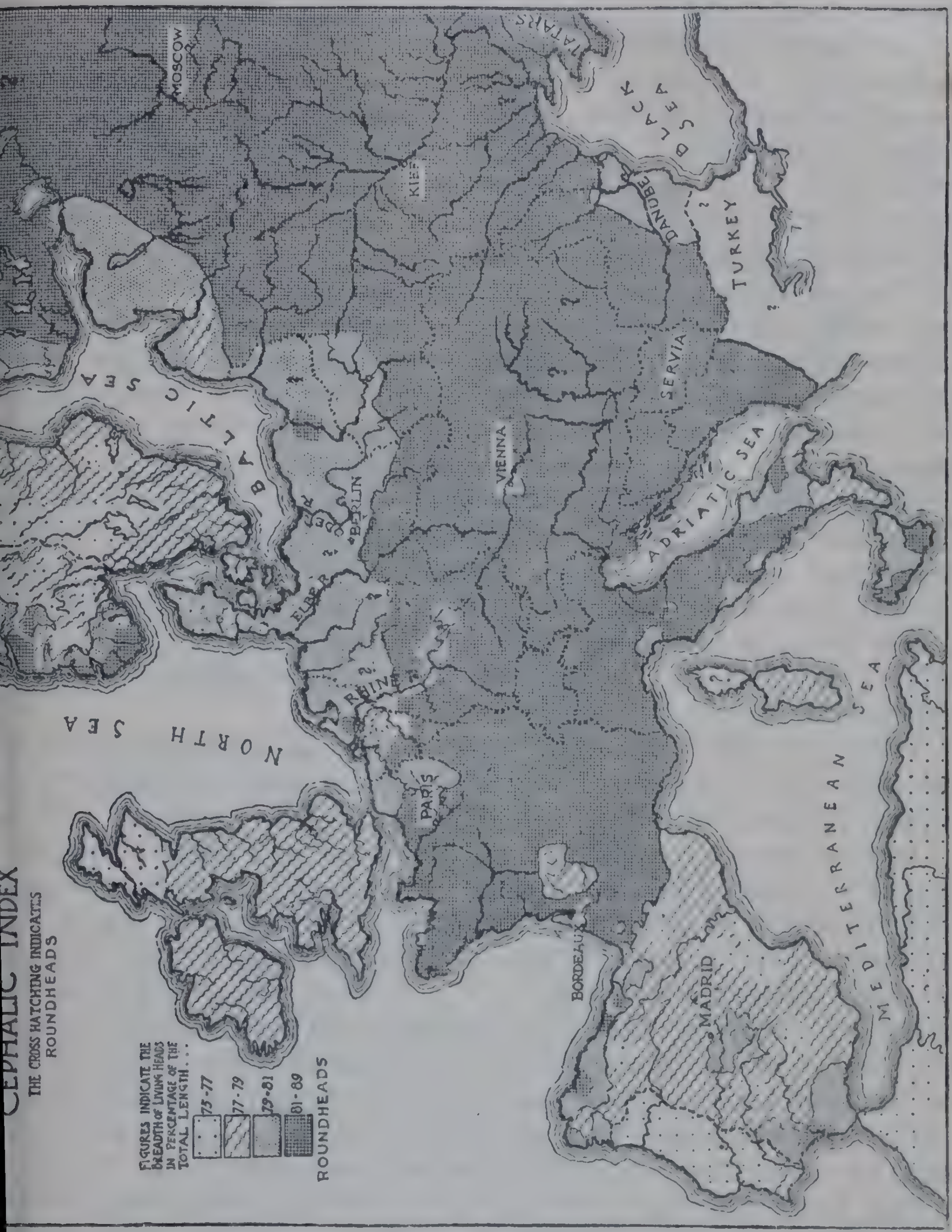

Fig. 2.—EUROPE: MAP OF CEPHALIC INDEX (MODIFIED FROM RIPLEY)

much interest attaches to “ blood groups,” and such high hopes
at one time entertained as to the assistance they would prove to the
ropologist, that it seems advisable to devote some little space to
, though in the present state of our knowledge their importance is
bly less than was at first hoped.

was discovered in 1900 that there were definite substances in the
n of some bloods that would agglutinate, or clump, the cells of cer-
other bloods, and it was further shown that on this basis blood can
assified into four groups.[1] These groups are commonly represented
e Roman figures I, II, III, IV (sometimes by O, A, B, A B, with
ence to the bodies theoretically causing agglutination) and the chief

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[1] or a good account of human blood groups see L. H. Snyder in *American*
al of Physical Anthropology, 1926.

anthropological interest of the blood groups lies in the varying percentag of each group in different peoples, for it was soon found that differe populations—we dare not as yet say races, except in a restricted sense were characterised by different frequencies of the four groups. Eve where we find both II and III, but the proportion varies : *e.g.* to ta large units, II is high in Caucasians, relatively low in Asiatics a Negroes, while III, comparatively high in the two last groups, is low Europeans. Thus, in a general way, it may be said that while II is hi in Western Europe this group falls in frequency towards the south a east, while III rises. But, with the exception to be noted immediate it does not appear that the differences are sufficiently clear cut to enal the human varieties to be differentiated by blood tests. These tests, th fail to justify the more extreme hopes entertained in the early years their discovery ; rather must they take their place among the older a better-known criteria. Nor is this to be wondered at when it is reme bered that groups II, III, and IV have already been found in the f orang-utan tested, while I and II have been found in the chimpanz for it is obvious that these facts indicate the high antiquity of the grou unless indeed it be claimed that, unlike other anatomical traits comm to apes and men, they are not part of a common heritage, but arose dependently by parallel development.

There are, however, certain facts of great anthropological interest the distribution of group I to which allusion must be made. To put briefly, this group is found in an unusually high percentage of individu of certain peoples occupying areas which are in a sense " outliers," that it has been suggested that its presence in high frequency may looked upon as an indication of the degree of isolation of the peoples whom it occurs. A group of North American Indians (483), believed be pure-blooded, give 91.3 per cent. of I, a percentage so high as to le to the conjecture that before the Discovery the percentage of I may ha been 100, while, as pointed out (p. 475), the variation in type in the habitants of America (other than arrivals in the last 500 years) has nec sarily required a relatively lengthy period to come about. But against t must be set the Australians (1176), with a percentage of I of 52.6. T is only moderately high, and not so high as might be expected for Australians on the isolation hypothesis. For it is a fact that the Austral must be regarded—for reasons that cannot be given here—as a m primitive and isolated member of *Homo sapiens* than the American Indi while again the Australians show nothing like the degree of variat found in the latter. Actually the Melanesians of New Guinea (certai with an element of Polynesian blood) and the Negroes of West Africa h about the same percentage of members of group I as the Australia Moreover, one observer's figures give 45.5 and 54.5 of I and II for Cen (Arunta, etc.) Australians, leading him to regard their blood grouping ultra-European.

The following table shows at a glance some of the data—its figu taken from Ruggles Gates, *Heredity in Man* (1929)—furnished by rec investigators, on which the above paragraphs are based.

Population	*Number*	*Groups* I	II	III	IV
mericans	5,000	44.4	36.0	14.2	5.1
ermans (Schleswig-Holstein)	3,156	40.7	41.3	12.5	5.3
ussians (Moscow)	2,200	32.0	38.5	23.0	6.5
hinese	1,000	30.0	25.0	35.0	10.0
indus (India)	228	31.8	18.5	40.9	8.7
ypsies (Hungary)	385	34.2	21.1	38.9	5.8
ustralian natives	1,176	52.6	36.9	8.5	2.0
elanesians (New Guinea) ..	753	53.7	26.8	16.3	3.2
egroes (W. Africa)	325	52.3	21.5	23.0	3.2
ndians (N. America)	1,104	79.1	16.4	3.4	0.9

similarity of the blood of Hungarian Gypsies to that of Hindus, ounting to practical identity, will be noted, though the former left their ian homeland hundreds of years ago.

e may add, as facts of the greatest interest though only indirectly cerning the subject of this Article, that: (1) Although, as might be ected, a new-born child, in whose vessels its mother's blood has been ulating, is of the same blood group as its mother, its own blood group etermined by heredity—asserts itself after a few months, and this is necessarily the blood group of its mother, indeed it often is not. The inheritance of the blood groups is on Mendelian lines,[1] though e is some disagreement as to the exact formula.

is important to distinguish between race, nation, and people. As ady stated, race is defined by anatomical characters, but it must be hasised that the living races of the anthropologist are not regarded orresponding to the species of the zoologist, but rather to smaller ps, varieties or possibly sub-species. Moreover, apart from anato- l peculiarities, races may exhibit physiological peculiarities in matters mperament, *e.g.* it seems agreed that Negroes are more musical than es. "Nationality" stands apart from race and is in the main a matter istory and politics, indeed most nations are composed of more than race, *e.g.* the British nation is mainly a mixture of Nordic and Medi- nean races. The term "people" is generally used in a rather inde- inate sense, usually fairly obvious and often connoting a group that ither racial nor national but united by some other lien, as for instance uage, or some other particular form of culture. Tribe is commonly ed to a unit of the lower cultures, whose members have a common ue, and, like those of a nation, usually act together in external affairs.

nguage, which has been more studied than any other single human ity, is of such vast practical and political importance that it is some- hard to remember that this is but a special form of culture, no more erion of race or of primary assistance in classifying peoples than any cultural feature. But because of the large part that language has d in our lives and cultures, as well as on account of ancient habit, habitually transfer linguistic terms to racial units, and only use dictates whether this is " good " or " bad " anthropology. Thus we sp of Semites, though " Semitic " is essentially a linguistic term, and t usage is sanctioned by anthropology, while to speak of Aryans in a ra sense is not generally considered permissible, perhaps because of enormous area peopled by the most divergent races over which Ar tongues are spoken. Nevertheless, similarities and differences in langu are so striking, often go back so far, and are of such deep significar that everywhere in the less well-known parts of the world classificat tends to be largely linguistic, as for instance in Africa, where the distri tion of the great families of language (see map) in a broad sense c responds almost everywhere with ethnic reality, so that in general c line ethnic and linguistic maps of Africa—except in the north—wo agree if superposed.

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[1] r a full discussion of the Mendelian Theory, see the Article on *Sex*,
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Although the study of temperament is only beginning, it seems nec sary to say something about this, for if temperament be regarded fr the racial aspect it will be seen as an important expression of racial me quality. We will therefore deal briefly, on the appropriate pages, w the races of Europe and two highly civilised peoples of the Far East, Chinese and Japanese. There are, however, certain pitfalls that must borne in mind and allowed for. Social position—class—is perhaps important as race ; again, time, in the sense of the period of a civilisat counts for much, *e.g.* to call the members of the oldest of Eastern civil tions " cruel " because torture and horrible modes of death were so times resorted to in recent times, with the implication that the w races are not cruel, seems little to the point in the members of a na which two or three centuries ago used to " hang, draw, and quarter " political enemies, while it is certain that no nation or people could h taught the Inquisition anything in the way of torture.

THE RACES OF MAN

The earlier attempts at the classification of mankind into a small nu ber of great racial divisions are of historic interest only, nor is this place to discuss the relative merits of the more modern plans, non which are ideal. In practice the following scheme, with six races, and f or six great divisions of mankind, according as to whether we retain term Caucasian as a synonym for the " white " man, probably work well as any :—

The Nordic Race The Alpine Race The Mediterranean Race	Together comprising White or, to u conventional but extremely conven term, Caucasian Man [1]
The Mongol Race	Yellow Man
The Negro Race	
The Australian Race	

This is the scheme we shall adopt, though pointing out some of more obvious difficulties, or at least infelicities, of nomenclature.

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[1] Two other " races," the Dinaric (p. 441) and the East Baltic, are somet recognised, but are probably best regarded as of mixed origin.

No sooner is the Alpine race constituted than its western members nediately fall into two great sub-groups : the European Alpine round-d, with a cranium that suggests part of a sphere, and the Armenoid Asia Minor, with the back of his head (occiput) flattened, great basi-tical height, and in the living a nose so definite in shape that it is given pecial name, " Armenoid." As to the so-called Dinaric race inhabiting head of the Adriatic and neighbouring lands, if it is not a race of equal ue with the other three European races—as some anthropologists con-er it to be—it must be regarded as a greatly modified variety of Alpine, as a cross between Alpine and Nordic with perhaps a touch of the nenoid. Again, in Central Asia and the Far East, there are two groups ich are both certainly Caucasian and perhaps both Alpine. These are Turki and the Ainu. The former have a yellowish-white complexion, ndant hair, and a tendency to obesity—a quality apparently running it through the Alpine race—very high brachycephalic head, straight and minent nose and dark but non-Mongolian eyes. The Ainu of Japan the neighbouring islands, with their mesaticephalic heads, hairy ies, and rosy complexion, can only be regarded as of the white race, erein, unless we call them proto-Caucasian and speculate no further erhaps the wisest course—we may agree that they belong to the Alpine e.

The Mediterranean race includes not only such obviously related ins as the Hamite and the Arab, but is enlarged by some authorities mbrace the Dravidians of Southern India and Ceylon, with aberrant es of their own as extreme as the Todas, distribution going far beyond admitted by Sergi, whose work, *The Mediterranean Race* (1901), is *locus classicus* for the use of the term.[1]

Iaving pointed out these difficulties, we shall first describe the distri-on and physical characters—the latter very briefly—of the six races nan, and then pass on to describe the chief peoples of each of the t geographical units of the world—Europe, Asia, Africa, America, Oceania.

White or Caucasian Man

he Nordic race includes such North Europeans as the Scandinavians, nings, Dutch, many North Germans, and some Russians. Many lish and Scotch—particularly the allegedly " typical," *i.e.* aristocratic of Englishman—must also be included, though the basis of the r population of the British Isles was Mediterranean.

he Alpine race includes European Alpine and Asiatic Armenoid ches. To the European Alpines belong the Swiss, South Germans, s, French, and North Italians. This branch extends into Asia, and to ust be reckoned the Persian Tajik and the mountaineers of the irs, among whom a type prevails which tallies almost exactly with the Swiss representatives of the Alpine race. The West Asiatic branc *i.e.* the Armenoids, is represented in antiquity by the Hittites (or o of the stocks entering into their nation), whose gods are pictured wi the exaggerated Armenoid nose of the comic-opera Jew. At the prese day the Armenoids are found in Armenia, the Levant, Mesop tamia, and Southern Arabia, and have given their characteristic nc to many Jews and Arabs. Of the Turki we have already said somethi on p. 441.

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[1] n 1911 Elliot Smith suggested the term " brown race " for the peoples of -Egyptian type, *i.e.* the Mediterraneans of Sergi, and for a number of e, or an element in the population, of lands outside Sergi's area—the in-ants of Southern Persia, Mesopotamia, some coastal parts of Asia Minor, he Nēsiots of Malaysia (*The Ancient Egyptians*, 1923).

As already stated, it is doubtful whether there is a Dinaric race; there is it must be included here.

The Mediterranean race includes the inhabitants of the Mediterrane peninsulas and islands—when these have not been overlaid by Alpin (Greece and much of North Italy)—of parts of Arabia (Semites) and Africa north of the Sahara, where as Berbers they constitute the Northe Hamites or Libyans, even crossing the Sahara (Tuareg, and such trib as the Cow-Fulani, *i.e.* those who have not absorbed much Negro bloo and so impinging on the Negro. All these may perhaps best be regarded constituting a Northern branch of the Hamites. The Southern or Easte branch includes Egyptians, Beja, Berberines, Abyssinians (with infusi of black blood), Somali, and Galla. It will be remembered (p. 435) th many of the peoples of this branch, even when free of Negro blood, a so dark complexioned that the layman, forgetting the quality of th features and the form of their hair, scarcely recognises them as Ca casians.

Passing eastwards, there are such less typical, indeed doubtf "Mediterraneans" as the Tamils of India and related peoples.

Many Semites (Arabs and Jews) carry much Armenoid blood, a stra thought to have come in during the first millennium B.C. Apart from th Hamites and Semites exhibit many physical and cultural features in co mon (including linguistic affinities), indeed there is good evidence for t existence of a former Hamito-Semitic culture.

The Mongol, or Yellow Man

The Mongol race, with many areas of interpenetration and conta metamorphosis, spreads westwards across Asia from the Pacific Ocea nor is it possible to state its western boundary with any precision account of frequent mixture and often confusion with stocks of Tu origin. It is however true to say that the great mass of the Yellow ra lies east of longitude 80°. We have no certain knowledge of its area characterisation, but considering the predominance of the Yellow ra in Eastern Asia—with its great mountain ranges and former ice barri of the Glacial Epoch—we may believe that its cradle-land lay in area that we now call the Far East, south of 40° (the latitude of Pekin perhaps in the fertile plains between the Yellow River and the Yangt kiang.

"Wherever the race acquired its distinctive features, it wandered and wide as soon as climatic conditions permitted, north into Mongo Manchuria and Eastern Siberia; west into Turkestan and Tibet; a south into Yunnan and Burma, and into what we now call Indo-Chi

Malay Peninsula, and the Malay Archipelago. Different groups had
umed distinctive characters, so that Northern, Southern, and Maritime
ngols became differentiated ; and as the first and third of these sub-
isions intermingled freely with other races, their differences from the
uthern Mongols (who exhibit the characteristic features of the race in
ir extreme form) became further emphasised. To interpret the
ysical characters of the people we have to picture members of the
ngolian group wandering away from the centre (where the most
ensive specialisation of racial characters was taking place) before the
cess of differentiations was far advanced, for on the fringe of the
ngolian domain one finds members of the race differing less emphatic-
from other human beings than, say, the Chinese do. But as this
ge extended its wanderings, it came at length into contact with the
anding edges of other races, in particular the Alpine people in Central
a, and the Indian and Indonesian people . . . in the south.”[1]

he physical characters of the Mongols are particularly well defined.
e skin is some tint of yellow or yellowish brown ; eye brown, generally
k brown ; the hair is coarse, straight (almost circular in section), and
erally sparse, noticeably so on the face ; the head is generally round
t in some groups mesaticephalic) ; the cheek-bones are broad, and so
minent that, taken with the characteristic absence of depression
ween nasal root and forehead and the slight development of the brow-
ges, the whole face tends to have a peculiar flatness, which is as
racteristic and much more general than the very distinctive “ Mon-
an ” eye. Where the “ Mongolian ” quality is well developed, the
er part of the upper eyelid is continued over the inner angle (inner
hus) of the eye, the skin fold so produced extending to and fusing
the skin at the side of the nose ; it is this, with the narrow aperture
veen the upper and lower lids, so common in Mongols, that gives
proverbial narrow oblique appearance to the Mongol eye, the orbits
nselves and their position in the skull not differing significantly from
e of other races. Stature is usually short (about 64 in.), but the
hern Chinese are often tall (70 in. or even more).

he Yellow race is usually divided into Southern, Northern, and
anic Mongols.

he Southern Mongols, who in recent literature are tending more and
e to be called Pareoean, have a geographical distribution that includes
t, the southern slopes of the Himalaya, China and Indo-China to
r south as the isthmus of Kra. In general they conform to the Mongol
ical type, but are perhaps rather shorter (this does not hold for
hern China) with an average height of about 63 in. Many Southern
gols carry a considerable strain of foreign blood, *e.g.* the more
sed Tibetans (Bod-pa) are described as betraying a considerable
xture with Hindu elements, while the peasant folk of the bleak
nds (Dru-pa) have clear brown or even hazel eyes, and among their
ger women rosy cheeks are quite common. In China too there are
divergences from the type ; thus in Northern China skulls are mesati-
alic (C.I. 77) rather than round, and, as already stated, stature is

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[1] G. Elliot Smith : *Human History* (1930).

The great mass of Northern Mongols occupy Siberia, stretching fr Japan to Lapland and coming south (roughly) to the Great Wall a Northern Tibet. Beyond this, west and south, there is a strong Mon strain in many Turki and Finnish groups. Taking the Tungus as fa representing the Northern Mongols, the highly brachycephalic skull these and similar peoples gives place to mesaticephaly in some of mixed groups, including even Siberian tribes such as Ostyak and Vo (C.I. 77), while the Koreans, often with hazel eyes, have an aristocr relatively tall and slim with long narrow noses. How this foreign str reached Korea is unknown ; in Japan we may fairly attribute the rosy sk which is by no means uncommon, to Ainu admixture, though this not explain the long and narrow noses of the aristocratic type.

The Oceanic Mongols range over Indonesia (including the Philippin Formosa, the Nicobars (much modified), and Madagascar. These the shortest of the Mongols, the stature in some groups scarcely exceed 60 in., and include the darkest skinned members of the race (so Malays). The hair is as among other Mongols ; the skin colour va from a faint tawny yellow to reddish brown ; the skull is brachycepha (sometimes mesaticephalic) ; eyes black, often with Mongol fold ; n often small, with rather wide nostrils.

There is an undoubted connection both physical and cultural betw certain island groups of Oceanic Mongols and some hill tribes of Assa In the latter there is a very great variety in physical, especially fac type, while in Borneo we can easily differentiate brachycephalic a mesati- or dolichocephalic types, some of whom show *inter se* a consid able degree of facial variability. This variability of head and face leads to the conception of a long-headed stock which has to a greater or le extent permeated the island groups. This stock, often called Indones (resulting in much confusion), is better called Nēsiot. It is difficult if impossible to isolate the type, for it has everywhere been mixed w round-headed yellow men. Haddon suggests that the Nēsiot type short (60–62 in.), mesaticephalic—probably originally dolichocephali with black hair often tinged with red ; skin tawny to rather light brow " lozenge-shaped face, cheek-bones sometimes projecting ; nose of flattened, sometimes concave."[1] The Murut of Borneo (C.I. 73) proba contain as much of this Nēsiot blood as any other island people.

Lastly, we must remember that the Mongols have crossed the Pac *via* Behring Straits and the neighbouring islands, and peopled Amer

The Negro Race

The Negro race has two great branches, an African or Negro, and Oceanic or Melanesian. In connection with both these great areas th exist negroid jungle folk of diminutive size and of much lower cult than their taller neighbours ; these are the Pygmies, or Negritos, wh African representatives are often called Negrillos.

There is no satisfactory evidence as to the cradle-land of the Ne race, nor is the relation of Negro to Negrito at all clear in the nat history of man. While some authorities regard the Negritos as hav en from their taller neighbours (by what can only be called degenera-) this view is not generally accepted and in fact seems untenable ; er should they be considered to represent an early human type, fantilistic" both physically and mentally.

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[1] *The Races of Man.*

lthough it is broadly true that the whole of Africa south of the ara is inhabited by "Negroes," by far the greater number of these otes, half-Hamites, Bantu) are not pure Negroes but carry more or of Hamitic blood, the true Negro being confined to West Africa in neighbourhood of the Guinea coast. The true Negro is tall (68 in.), lly-haired, with a skin so dark that it is often described as black ; tly built, short-legged, long-armed ; the head dolichocephalic . 73–75) ; the face often prognathous, with thick everted lips ; fore- l often bulging, and nose platyrrhine.

he Oceanic Negroes are represented in their purest form by the uans, an obscurely variable stock with black woolly hair, skin dark colate or sooty brown ; usually of medium stature ; long-headed and d-nosed, often with retreating forehead and prominent brow-ridges. ir stronghold at the present day is New Guinea ; formerly no doubt had a wide distribution in Melanesia, probably in Australia, and present as a variety in Tasmania.

he Negrito are the peoples generally termed Pygmies. They are very t, dark-skinned, woolly-haired, broad-nosed, mesaticephals or hycephals. In the east they include the Andamanese (st. 58½ in., 83), the Semang of the Malay Peninsula (st. 60 in., C.I. 79), the of the Philippines (st. 58 in., C.I. 82), and the little-known Tapiro etherlands New Guinea (st. 57 in., C.I. 79.5). In the west the African rito (Negrillo) of the Equatorial forests (Akka, Batwa, etc.) are the test of mankind (st. about 54 in.) ; they are mesaticephalic, with hair dark than the eastern Pygmies, short in the trunk, with long arms and and features tending to infantile type.

he Bushmen are probably to be related to the Pygmies, though their colour is yellow and their average stature 5 ft. or just over. Head ticephalic, face flattened, orthognatic, with prominent cheek-bones very wide nose. The women tend to exhibit that peculiar develop- t of fat on the buttocks which is called steatopygy.

ie Hottentot is in many respects a magnified Bushman brought t by an infusion of Bantu and Hamitic blood (st. 63 in.). The women requently steatopygous.

ie ears are often lobeless in both Bushmen and Hottentots.

The Australian Race

ie Australian race includes the Australians and the pre-Dravidian s of Southern India and Ceylon (Vedda), the Sakai of the Malay nsula, and probably the Toala of the Celebes, though these latter to have absorbed much foreign blood. Throughout the race the s black, wavy or tending to curly.

e Australians are of medium height, with an average stature around n., but varying in different groups ; the skin is a dark chocolate n, often very hairy ; the head is long, with flat retreating forehead and prognathous jaw, the brow-ridges prominent (often excessively s the nose depressed at root and often very broad.

The Sakai are short, with a stature scarcely reaching 60 in. ; a redd tinge in the hair ; skin yellowish to dark brown ; skull mesaticepha (C.I. 78) ; nose high mesorrhine.

The Jungle tribes of Southern India (Kurumba, Irula, Paniyan, et and Ceylon (Vedda, almost extinct), are short (60–62 in.) dolichoceph (C.I. 70–75), often with prominent brow-ridges and nose genera platyrrhine. The hair may be frankly curly (Kadir and Paniyan, in wh Negrito influence is possible).

EUROPE

Disregarding the remains of palæanthropic man found in Europe a dating back to the lower and middle palæolithic, “ neanthropic man ” we know him—the *Homo sapiens* of Linnæus—appears in the Aurignac period, *i.e.* at the beginning of the Upper Palæolithic. All these w long-heads (though certain undescribed skulls of high mesaticeph have been stated to be of Aurignacian date). Round-heads do not app until epipalæolithic (mesolithic) times, when their remains are fou at Furfooz (Belgium), Offnet (Bavaria), and Mughem (Portugal) ; p sumably these were the vanguard of the present-day European rou heads constituting the Alpine race of Central Europe, but we know li of the early history or spread of this race.

Coming to the New Stone Age, we find the coasts of the Medit ranean and the coastal areas of Western Europe populated by a rat short narrow-headed race, who as they spread over France and mu of the British Isles introduced the megalithic culture[1] into West Europe. They and their descendants are of the Mediterranean race. do not know at what date this race entered Europe, but its Egypt representatives in the Nile Valley—the predynastic or proto-Egyptian were a flourishing agricultural people as early as the fifth millennium Following Haddon, we may assume that there was a great influx Alpines into Europe about this time, indeed “ we may reasonably c clude that Alpine man introduced into Europe cultivated grains fruits, domestic animals, polished stone implements, painted pott weaving, and possibly at a later date the art of metal-working. It to them that the lake-dwelling cultures were due, and mainly also i to their descendants that we owe the Hallstatt and the La Tène [Iron A cultures, but both these were strongly influenced by the culture brou by tall, fair, long-headed Nordic man from the northern plains Europe. . . .”[2]

The origin and early history of the Nordics is unknown, but t homeland is generally considered to have been the South Russian step or in their neighbourhood. One view regards them as a giant blo variant of Mediterranean man, a change supposedly analogous to ıe brown bear which gave rise to the polar form. Whether this be so ot, we may agree that an early steppe-folk of Eastern Europe and tern Asia had been spreading westwards at various times and in rent culture phases, and some of these " proto-Nordics " may be posed to have passed northward into Scandinavia to become the stors of the Nordics of our own times.

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[1] By megalithic culture is meant a culture in which structures compose large, usually rough, unhewn stones play a prominent part. Dolmens, cir and triliths are common examples of megalithic monuments.

[2] *The Races of Man.*

ıe ethnology and history of Europe are the ethnology and history of races, and the crosses that arose from them, with that of certain ding groups in historic times. Of the latter the only important inons were those into Hungary and the Balkan Peninsula, bringing Europe three Turki peoples, the Magyar, the Osmanli Turks, and Bulgars. The two former have kept their Asiatic languages, and the yar have become completely European in physique and culture, the prevalent physical type being described as somewhat brunette with nut hair and light eyes; the cephalic index is high (84), with a um stature of 64 to 65 in. As regards the Turks, an ethnically mixed i nation settled down in Asia Minor in the eleventh century, but the er inhabitants were by no means exterminated; on the contrary, great numbers embraced Islam, " many thousand children were ed by the knife of circumcision, and many thousand captives were ted to the service or the pleasures of their masters."[1] It is the desants of these already mixed Turks, modified by centuries of interiage with the European population of the Balkan peninsula, that itute the European Turks of the present day, so that it is no wonder in appearance they retain but little of their Asiatic origin.

ıe Bulgars, who reached their present homes in the seventh century, become completely Slavonicised, but their speech contains more s of Turki origin than any other Slav language.

ough we neglect the other European peoples and nations as being ell known to be of interest in a summary account, some mention must ade of the Basques, if only on account of the quantity that has been en about them. Occupying the western Pyrenean provinces of France pain, it is said that sixty years ago there were perhaps half a million e who spoke their extraordinary language and who had until then eded in maintaining intact much of their peculiar politico-social isation :—

heir political institutions were ideally democratic. . . . In Vizcaya, ample, sovereignty was vested in a biennial assembly of chosen ies, who sat on stone benches in the open air under an ancestral ee in the village of Guernica. This tree was the emblem of their es. A scion of the parent oak was always kept growing near by, in he old tree should die. These Basques acknowledged no political ign; they insisted upon complete personal independence for every they were all absolutely equal before their own law; they upheld nother in exercising the right of self-defence against any outside ity, ecclesiastical, political, or other; they were entitled to bear t all times by law anywhere in Spain; they were free from all taxave for their own local needs, and from all foreign military service;

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[1] Gibbon, chap. lvii., quoted by Keane.

and in virtue of this liberty they were accorded throughout Spain rank and privileges of *hidalgos* or noblemen."[1]

Their language is agglutinative (the ordinary European languages inflective), different meanings being expressed by the compoundin several words into one ; thus the verb includes all pronouns, adverbs allied parts of speech, and the noun similarly comprehends the prep tions and adjectives. A classical example, given by Ripley, meaning " lower field of the high hill of Azpicuelta" runs, *Azpilcuelagaray aroyarenberecolarrea*. The antiquity of this curious language is den by the slight development of the principle of abstraction or genera tion, " Thus there is said to be a lack of such simple generalised w as ' tree ' or ' animal.' There are complete vocabularies for each spe of either, but none for the concept of tree or animal in the abstract, condition paralleled by numerous primitive peoples, *e.g.* the Chero who are said to have thirteen words to signify the washing of diffe parts of the body but none for the idea of " washing " itself. The cru of the verb is another primitive feature, most Basque verbs being in nouns (*e.g.* " to give " is treated as if it were " donation " or " the a giving ") and declined as such.

As to its origins, and the affinities of the people who originally spok nothing is known. The idea that Basque is an Hamitic language aki Berber has broken down, and we are left with the bold and seductive gestion of Elliot Smith that it represents the speech of Upper Palæoli man.

Physically there is no uniformity among the Basques at the pre day ; dolicho- or predominantly mesaticephalic in Spain, they brachycephalic in France. Nevertheless a good case can be made ou a definite round-headed long-faced type, with a bulging forehead refined oval jaw, which it is suggested may have developed *in situ*, if so, then no doubt as a result of interbreeding and selection.

Examining the temperament of the three great European race relation to Jung's behaviour types (introvert and extravert), it seems though the Nordic race excels other races in determination, this st fastness shades into stubbornness which, in the individual, is likel lead to recklessness as to the results of his actions not only to himself to others. His power of organisation is of great social value and, with fighting capacity, accounts for his genius for imposing himself a aristocracy dominating other peoples ; nevertheless he is essentiall individualist, and as such shows a definite incapacity to understand sympathise with views not his own. However his natural reserve prev his thrusting his views on others, *i.e.* his general attitude is intro McDougall says he is " weak in herd instinct." It would be more accu to say that his " herd " tends to be small ; indeed there is abun evidence of this in the sagas, wherein we may find Nordic traits vividly portrayed than anywhere else. It seems that it is this individual (with perhaps a certain capacity for mysticism), which in the relig sphere has led to that protestant tendency, which contrasts so sha with the dominant catholicism not only of Mediterranean but of Al

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[1] Ripley : *The Races of Europe* (1900). [2] Ripley : *op. cit.*

The Nordic “ is distinctly religious and philosophical, but his
ngs, not being easily satisfied, tend to drive him beyond the
and into mere metaphysic.”[1] Nevertheless, he has an undoubted
de for science which is, perhaps, reinforced by a capacity for ob-
ion that seems to go with his love of the sea and of the country as
ed to the town. It is these last qualities, combined with his indivi-
m and pugnacity, that have made him the finest explorer and col-
in the world.
Alpines of Europe are predominantly Catholic, and lack the stub-
ndividualism of the Nordics, while it is generally agreed that they
ecially suited to life in small communities and show little tendency
enture and colonisation, and it is alleged that with this there goes
ive absence of genius or outstanding ability. A certain quality of
eness has been attributed to the Alpines ; if this be so, another
of this quality might be the steadfastness and capacity to bear
ment which the Swiss wars of independence showed them to possess.
Mediterranean race has been described as vivacious, quick, im-
ıs, impulsive ; with emotions blazing instantaneously into violent
sion and action. This may be true as it stands, and no doubt the
erraneans generally are extravert, though if, as is generally stated,
uth Italians—the most pronounced Mediterraneans of the group—
olly shape their actions for years towards the consummation of
etta, the description is perhaps somewhat exaggerated. The Medi-
eans show an intense appreciation of colour, glitter and movement
ere is no doubt as to the important part played by coloured illus-
s in their papers, even at a time more than a quarter of a century
hen colour was but sparsely used in Western European journals.
ld be interesting to know whether this applies alike to Italy and
and whether it is equally true of Northern and Southern Italy.
ver conclusions we may come to concerning the above, it can hardly
ied that the Mediterranean race has actually more achievement to
dit than any other, since it was responsible for by far the greater
Mediterranean civilisation, certainly before 1000 B.C. (and prob-
uch later). We know little of the physical characters of the Hellenic
, but may regard them as basicly Mediterranean, with a strong
ure of Alpine and no doubt some Nordic. Thus the Mediterranean
aped not only the Ægean cultures[2] but those of Western as well
greater part of Eastern Mediterranean lands—including the Su-
civilisation of Ur and Kish—while the culture of one branch, the
c pre-dynastic Egyptians, formed the basis of that of Egypt. Rome
osely omitted on account of the doubt there is as to the ethnic
ship of the Romans, some holding that patricians and plebeians
different race and contributed vastly different proportions to
civilisation.[3]

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enz, in Baur—Fischer—Lenz : *Menschliche Erblichkeitslehre* (Munich,

ally the earliest Cretan skulls known dating 1500 B.C. and earlier are
sively long-headed.

alternate views are well set out in William Ridgeway, “ Who were the
?” (*Proceedings of the British Academy*, 1907) and H. J. Rose,
ans and Plebeians at Rome” (*Journal of Roman Studies*, 1922).

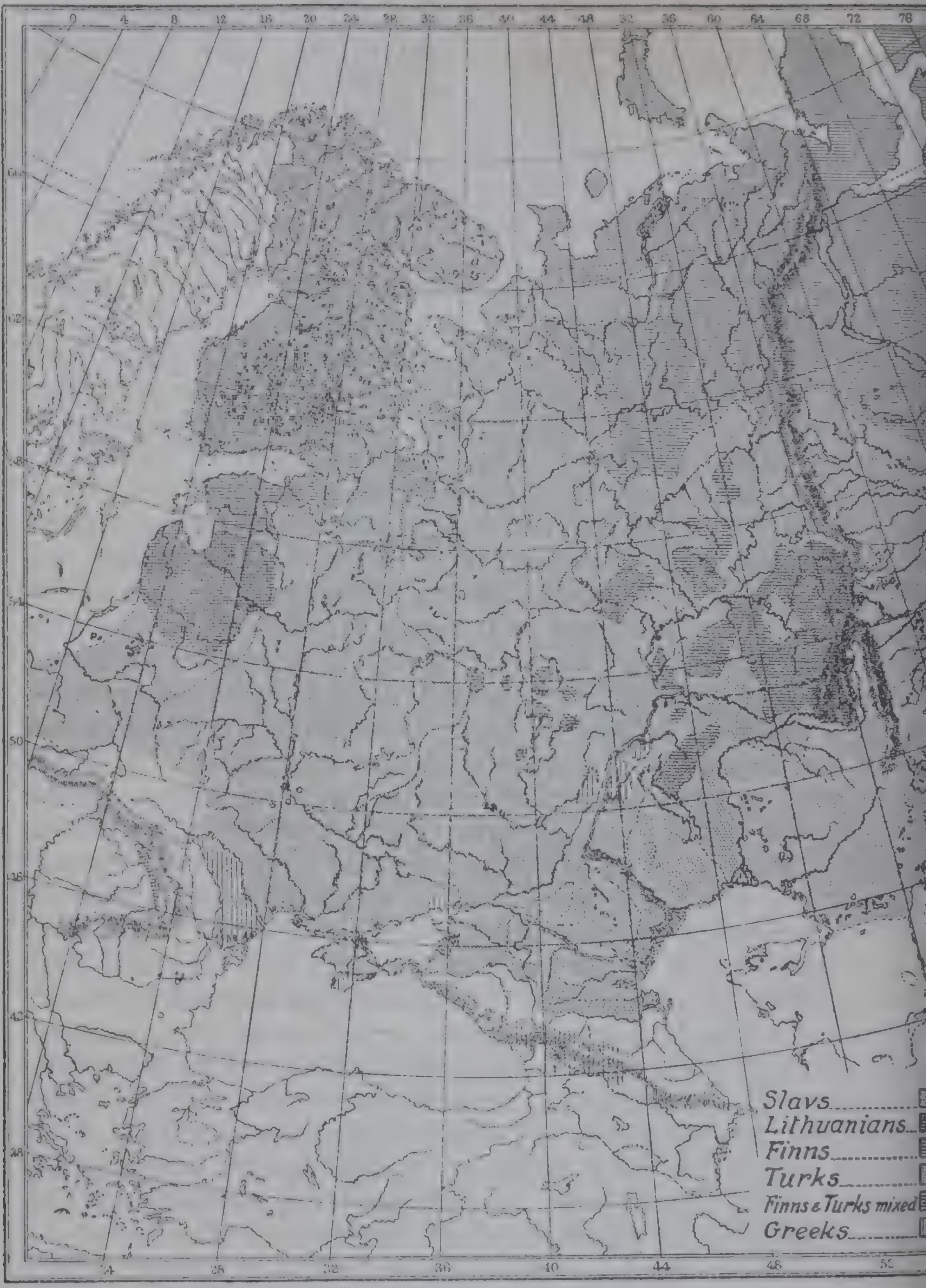

Fig. 3.—ETHNOLOGICAL MAP OF RUSSIA IN THE NINTH CENTURY

ASIA

The vast continent that we call Asia should, from the ethno-histo
standpoint, be yet further enlarged to include almost the whole of E
pean Russia, for it was only in the ninth century that that branch o
Alpine race that we term Slavs began to push into its dark forests,
then inhabited by Ugro-Finnish tribes speaking non-Aryan langu
whose representatives, now predominantly of European blood, incl

the Zyrian, Mordven, and Votyak of present-day European Russia, ill speaking their own languages.[1] In connection with this persistence siatics in a country that from our schooldays we have regarded as pean, it should be emphasised that the Urals, which on the map ar as a well-marked natural barrier between Asia and Europe, are ounded hills with many intervening gaps, nowhere attaining a height er 5,500 ft. (*see Fig.* 3).

e early history of man in Asia is entirely unknown. Implements of Drift type are abundant in some parts of Western Asia and in ; a Mousterian skull has been excavated in Palestine, and the Far has given us the remains of *Pithecanthropus*—the most primitive nid known—and is now yielding the remains of numerous indivi- of *Sinanthropus* ; but these finds no more than prove the varying s and wide distribution of Quarternary Man. Coming to more recent , the Ainu show such clear evidence of Caucasian affinities that we nly regard them as undifferentiated progenitors or representatives e of the European races, and though their skull is very different from nodern Alpine their appearance, summed up in oft-quoted resemb- to the Russian peasant, makes it reasonable to ally them to that race. relation of the great group of Western brachycephals, which in its ded sense we call Alpine, to the yellow roundheads (the Mongolian is quite obscure.

e main geographical features of Asia, upon which depend the dis- tion and cultures of its peoples, are three great belts of country, each more or less uniform features, running from east to west from the c Ocean into Europe, and south of these a high steppe with two great of plateaux—an eastern, including Tibet, Eastern Turkestan, and -West Mongolia with the Gobi desert, and a western comprising Armenia, and Anatolia. Southward and peripherally lie India, In- ia, and in the west Arabia, each with a history and ethnography of n, the first and last of such size and importance as almost to con- sub-continents in themselves.[2]

much for generalisations. Turning to the Near East (Anatolia, Mes- mia, Syria, but excluding Arabia), although there are indications e aborigines were Mediterraneans, round-headed peoples from the ave poured in from so early a period that even in Crete our oldest are not pure Mediterranean. On the other hand the skulls collected olley at Ur, judged to date from the fourth millennium B.C., clearly te that the early Sumerians were Mediterraneans.

ving for the moment the Near East, we may agree with Buxton to a " Middle East," to include the Turkoman and Uzbeg Soviet lics in the north, and Persia, Beluchistan, and Afghanistan in the [3] This is an area of ethnic confusion : there is certainly a large nt of Alpine round-heads, akin to or even identical with our Euro- lpines, and if it be admitted, as has been suggested, that the Turko- teppes are the area of characterisation of the Nordic race, then there

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ncerning these peoples see Ripley, *Races of Europe* (1900), and especially tribution map.

ia and Arabia are only about one-third smaller than Australia.

Peoples of Asia (1925).

s no difficulty in understanding the mixed types of this area, particu if weight be given to the presence of a Mediterranean type akin tc Dravidian, in connection with which we may remember that the Br of Baluchistan, though they are (now) physically Baluchi, speak a vidian language.

The Turki, whose physical characters are described on page 441, the basis of the Eastern Turkish peoples, *i.e.* the Turks of East Ce Asia—Kirghiz, Kasak, Uzbeg, Turkoman, etc. These folk are very mi differing considerably in social characteristics, and are very far in from any feeling of race solidarity such as that implied by the Pan-Tu (Pan-Turanian) movement of the War years. Uzbeg seems to be a of more political than racial significance, and the Kirghiz are said to much Mongol blood. Actually all these Eastern Asiatic Turks are t looked upon as the remains of the old Turkic stock—greatly mod by infusion of foreign blood—first known to history as the Hiung whose inroads, together with those of the Tung-hu (Tungus), led tc building of the Great Wall of China during the Ts'in dynasty, thus fo westwards the Asiatic *Völkerwanderung* of the first centuries of ou —a fact which, it is interesting to note, was appreciated by Gibbon s hundred and fifty years ago.

The Medes and Persians of history are regarded by Haddon as p Nordic, their blood still existing in the Farsi about Persepolis, " fa skin, with abundant hair and beard of a dark chestnut colour, [tho real blonds with blue eyes are rare." [1] The other Persian type—tall, l headed, and dark—is that which commonly represents people of im ance in Persian paintings. On the other hand the " moon-faced " b ties perhaps represent the type that may most fairly be termed Ira the Alpine Tajik (Tajik, Galcha, etc.) with a C.I. of about 85.

Arabia, the home of the Semites (and probably of the Hamites falls naturally into three main divisions, a northern, a southern, a third less well characterised central area between the Midian coast o west and the head of the Persian Gulf on the east. The northern div extends to the edge of the Syrian desert, and, apart from its oases, i habited by nomad pastoralists, and furnishes a barely adequate pastu for their limited numbers. The southern division contains the highl of Yemen and Asir in the west, which, with the Hadramut, form a h able zone round the great southern desert, continued to the east by O and Jebel Akhdar. The Yemen and Asir highlands enjoy a temp climate ; their population consists largely of agriculturalists, whose raced hills form one of the most characteristic features of the landsc The central zone includes El Hasa, Nejd, and the Hejaz, with the cities.

The population of the northern area—typical northern Semites with few exceptions dolichocephalic and narrow-nosed, with white easily bronzing, and of medium stature. They come nearest to the tr tional Arab of the text-books, " with a fine oval face . . . [a] type w . . . often assume an almost ideal beauty." [2] In the south an ent different type prevails : a " Beduin " tribe inland from Aden giv halic index of 81, moreover the stature is lower than in the north, and xamination of all the figures for Southern and South-Eastern Arabia cates that less than 10 per cent. are long-headed. We have very few surements derived from the central area; provisionally we may regard nhabitants as predominantly northern.

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[1] Haddon : *op. cit.*

[2] Keane : *Ethnology.*

bviously then, while the inhabitants of Northern Arabia are "Arabs" he commonly accepted sense and true Semites, the southerners are and though we cannot be certain who they are, it is most probable the round-headed element has come in from Mesopotamia, a gestion supported by the fact that, long before the sixth century A.D. th Arabia was a country of a thriving civilisation with an agriculture dvanced that irrigation works on a considerable scale existed and were in repair for hundreds of years. It may be added that within the last years Mr. Bertram Thomas, exploring the unknown country behind an, has found tribes who physically are of the South Arabian type who speak Semitic languages that are definitely not Arabic.

Iuch romantic nonsense has been written on the temperament and acter of the Arab. Arab loyalties are primarily to their group, *i.e.* to and family; the tribe comes next, and patriotism in the larger stern sense can only be described as uncommon. Where clan and tribal lty is all that is required by his environment the Arab lives happily ugh, and his social organisation may be regarded as successful, as ng the nomads of the Sudan and the Beduin of Arabia, but where ernment of larger or more coherent units is required he is apt to fail. eed on this matter the town Arab has few illusions, witness the Syrian erb, "You cannot make a pair of tongs out of wood nor a Pasha out n Arab." Generally religious, the pure-blooded Arab is less fanatical is commonly supposed; it is the mixed breeds, in whom there is an sion of Negro blood, that provide by far the greater number of fan-. It was no matter of chance that the Mahdi was a Dongolawi and Khalifa a Ta'aishi of the southern negroid cattle-Arabs (Baqqara) of dofan.

s might be expected, town folk, peasants, and nomads differ in ts and superficially in outlook, but they have a substantial fund of mon characteristics. They may fairly be described as "polite, intel-t, very kind and affectionate to their children and relations, diligent eir own affairs, almost completely deficient in patriotism and public . . . have considerable humour, are cheerful, excitable, extremely cious, always ready to bribe or take bribes, but otherwise fairly st."[1]

unterbalancing their avarice is a hospitality so generous as to have ne proverbial. It is a fact that except in large towns where inns nd any stranger will be provided with food and refuge without ght of payment, the nature of his entertainment depending far more s social position than on his wealth, and it is this hospitality, with eady kindliness that accompanies it, that has made for the Arab so admirers.

e Semites had overflowed into Palestine and Mesopotamia millenia

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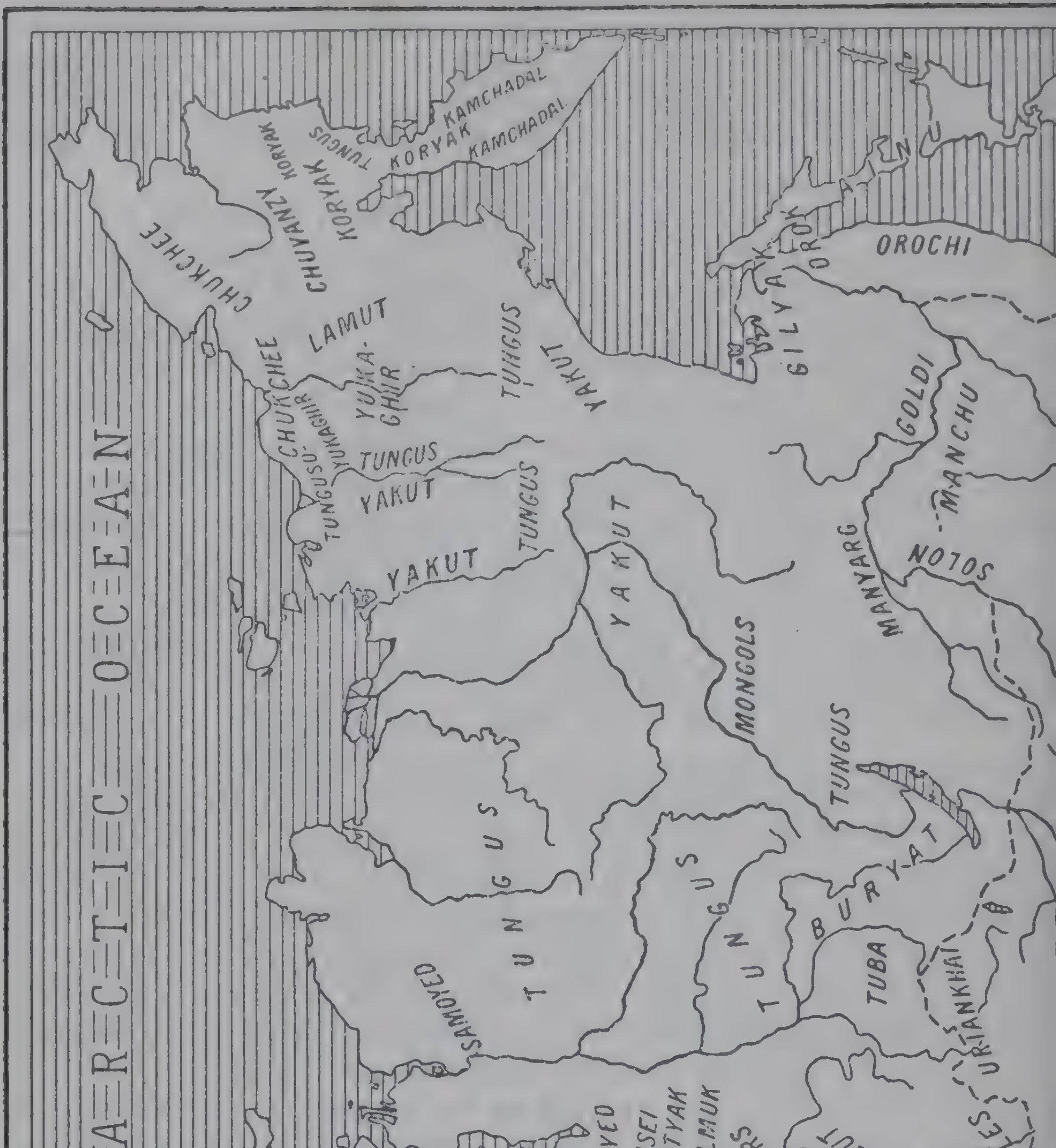
[1] ord Raglan: "Arab Life and Character" (*Nineteenth Century and After*,


ETHNOLOGICAL MAP OF SIBERIA
Scale 100 0 200 400 600 Eng. Miles
ARCTIC OCEAN
CHUKCHEE
CHUVANZY
KORYAK
KORYAK
KORYAK
TUNGUS
KAMCHADAL
KAMCHADAL
LAMUT
CHUKCHEE
TUNGUSO-YUKAGHIR
YUKA-GHIR
TUNGUS
TUNGUS
YAKUT
YAKUT
TUNGUS
YAKUT
YAKUT
YAKUT
AINU
OROK
GILYAK
OROCHI
GOLDI
MANCHU
MANYARG
SOLON
MONGOLS
TUNGUS
TUNGUS
TUNGUS
TUNGUS
SAMOYED
BURYAT
TUBA
URIANKHAI
SAMOYED
YENISEI OSTYAK
KALMUK
TARTARS
TARTARS
TELEUT
TELES
YURAK
OB OSTYAK
BARABINSK TARTARS
VOGUL
TARTARS
TARTARS
KIRGIS
KIRGIS
KALMUK KIRGIS

re our era. The Canaanites are regarded as Semitic, but the Amorites traditionally considered Nordic. The Abrahamic branch were ads who entered Egypt with the Hyksos and, after these were ex- d, entered Palestine, absorbing the former inhabitants into their ico-religious system but in the process themselves taking on, to a er or lesser degree, the physical traits of the earlier peoples. Thus Jews and Samaritans at the present day include light-eyed red- d strains, and the typical "Jewish" nose is the Armenoid nose of the tes, the ancestors of the present-day Armenians. The Assyrians too an Armeno-Semitic mixture—witness their characteristic faces as ayed in the long series of bas-reliefs from Nimrūd, dating from the half of the ninth century B.C., in the British Museum in London. e Jews of the present day are predominantly round-headed. They rouped into two stocks, the Askenazim in Northern, Central, and ern Europe, and the Sephardim in the South and in Spain, Por- , and North Africa.

Siberia, a vast area concerning which comparatively little is known, convenient to employ a broad classification, such as that proposed zaplicka, into Palæo-Siberians and Neo-Siberians[1] (*see Fig.* 4). The term is equivalent to the older term Palæo-Asiatic, and includes ipally Chukchi, Koryak, Kamchadal, Gilyak, Yukghir, Yenisei, and ak. All these, with the Ainu, may be regarded as very ancient peoples generally as living a simple life, specialisation, so far as it goes, having ly been forced upon them by the Arctic climate. But while it may ue that the Palæo-Siberians have been in Siberia for a prolonged d, the latest opinion is that they are a reflux from North-Western rica, and the best authorities hold that their language is American- n rather than Asiatic, this incidentally being the only accepted ex- e of relationship between Old and New World tongues.

e term Neo-Siberian implies no more than that we believe the c, Mongolic, Turkic, and Tungusic tribes which have populated ia to be relatively recent incomers. Czaplicka, quoting Patkanoff, a complete list of these tribes, of which all belong to one or other of ollowing stocks :—Finnish, Samoyed, Turki, and Tungus.

ese Palæo- and Neo-Siberians are the inhabitants of the tundra and , the two more northern of the belts referred to on page 451. They l more or less reindeer pastoralists, though some of the Chukchi ilyak are too poor to possess any and maintain a miserable exist- dependent on other groups. Other Chukchi, and, for example, the k, have large herds of semi-feral animals that cannot be milked and little use for transport, but are invaluable as meat and trade. Many us have good herds of reindeer, but may consider them too precious freely as food, especially as hunting, fishing, and trading are widely sed by this people, while the Samoyedic tribes are generally pastoralists, living on the milk and flesh of domesticated deer. eer herdsmen probably live a harder life than any other pastoralists quire really large flocks, for ten deer are said to give no more milk ne cow.

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[1] *Aboriginal Siberia* (1914).

The Low Steppe east of the Lena is mainly in the hands of Tu and Yakut; west of the river are Ostiak "Tartars," *i.e.* Turki and T Mongol folk, and such important Turki peoples as Turkoman, Kir and Uzbeg, with a broad zone of Russian settlement extending Saratov through Perm in a south-easterly direction.

Most of the pastoral tribes of steppe and tayga, though they oc such a vast area, can be passed over with what we have already said the Tungus are most important. They stretch beyond the limit of Si to include, *inter alia*, many Manchu, the Buriat (of Lake Baikal), a n ber of tribes of the Gobi area, the Kalmuk (Chinese Turkestan, Mong and Zurgaria), and the Taranchi of Eastern Turkestan. Naturally, sc flung a people exhibit considerable variation physically, yet in a ge way they conform to the characters given on page 444, *i.e.* they are brachycephals (C.I. 84.8), of medium stature (62½-66 in.), with ye or yellowish-brown skin, hair coarse, straight, and sparse, broad flat and prominent cheek-bones, broad nostrils and dark brown eyes, us typically "Mongolian."

The Tungus are praised by every traveller for their qualities character. They are described as "cheerful under the most depre circumstances, persevering, open-hearted, trustworthy, modest yet reliant, a fearless race of hunters, born amidst the gloom of their d pine-forests, exposed from the cradle to every danger from wild be cold and hunger. Want and hardships of every kind they endure surprising fortitude."[1] This, of course, only applies to the wilder h ing and reindeer Tungus; the Manchu, the southern, civilised and se section of the stock, until recently kept up the old clan system u military organisation into "banners," which enabled them to con the Chinese in the seventeenth century and to impose upon them Ch'ing dynasty, which endured until 1911.

The ethnology of Japan is one of the puzzles of anthropology. Not are we unable to make any definite statement as to who the Japanese but the most critical philologists cannot cite any linguistic stock to w the Japanese language is affiliated. We say "critical" advisedly, for n statements exist, but none so far has stood the test of time.

Considering the Japanese as a nation, we may say that they hav average stature of 63¼ in., and a cephalic index of 81.8, but this n gives little idea of the people. Two distinct types, each perfectly ch teristic, are immediately obvious. A coarse type, short and thick set, broad flat face, narrow and oblique eye, and typically a well devel epicanthus, a dark tawny-olive skin and the nose often concave; th obviously a thoroughly Mongol type. In opposition stands the "f or Daimyo type, taller, of slender build with long face and often long the latter sometimes prominent and arched, with the tip somewhat tened down, recalling vaguely the Armenoid form, though certainl to be given this term. This aristocratic type—familiar in countless c prints—was known, admired, and represented in sculpture as long as the seventh or eighth century, for the wooden statue of Prince Shō Taishi at Nara admirably represents it, as does a pottery figure lryman, probably of rather earlier date, recently excavated in Korea. he earliest inhabitants of Japan were the Ainu, still existing in Yezo, th Island, and the anthropologist travelling in Japan will soon feel vinced that even in the south where the historic " Japanese "—who- these were—first landed there is far more Ainu blood than the text- ks imply. Wavy hair (as in the Ainu) is not very uncommon, curly occurs, and there is often a rosy flush in the complexion which, if so marked as that of the Ainu, does strongly recall it. That the Ainu rminated an earlier people, the Koropakguru, the " Earth-Spiders " apanese legend, is now generally discredited, and the Ainu must be rded as the true aborigines. With them there mingled incoming d-headed Asiatics, indeed some of the shell mounds contain both ı and Asiatic skulls of the same date.

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[1] Keane: *Asia* (1906).

southern strain from the Indonesian islands has been generally re- ised, and there seems to be cultural evidence for this. The often- ed Negrito strain seems much more doubtful ; in fact the writer of Article would discredit it. It is true that the traveller is struck by the that he meets a certain number of very short Japanese, but the stature e Japanese has been carefully studied, and although a certain number ler 5 per cent.) are under 60 in., there is a larger number (over 6 per .) of tall subjects ranging from 67 to 70¾ in. Further, while carefully he lookout for individuals with negroid features, the writer failed to even a single subject.

ıt whatever the stocks that have gone to produce the Japanese people, esult is noteworthy and, if often puzzling to the Westerner, is gener- admirable, even if recent foreign influence has not always led indivi- s to show themselves at their best. Cheerfully patriotic in belief in country and themselves, with a high sense of honour, the Japanese in an eminent degree the qualities of citizens and patriots combined a rare capacity for united action. This genius for co-operation, so seen in business and politics, is one of the characters that differentiate from the only other Eastern people of equal capacity and civilisa- for, in spite of the wisdom, business sagacity, and individual success rticular Chinese, the latter have so little power of combination that have not produced a single great banking house or business firm, as the Japanese in numerous instances, while the same opposed charac- ics inform and shape the politics of these two great peoples. To say, sometimes said, that the Japanese are irreligious is untrue. They are tely a religious people—it is only necessary to go to one of the big les on a Buddhistic festival to appreciate this—but their religion is ful and assumes primitive virtue rather than original sin ; even in sanities, delusions of a religious nature with sense of guilt, so com- n this country, are practically absent in Japan. But this by no means es the absence of religion. The bravery and persistence under tor- f considerable numbers of the Christian Japanese in the seventeenth ry must surely be attributed to nothing else than strong religious g. What does strike the Westerner reading Japanese history and g to the older men is how efficiently the sense of decorum, with the lly Japanese appreciation of æsthetics, seems to have guided every It may be said quite fairly that the influence of Buddhism as a code was more æsthetic than ethical. So Japanese feudalism converted Buddha's doctrine of renunciation into the stoicism of the warrior; Japanese Samurai renounced desire not that he might enter Nirvana, that he might acquire the contempt of life which would make him a fect warrior.

As to the arts and crafts, it can scarcely be doubted that the Japa are gifted *en masse* with an æsthetic sense which makes it fair to wri them as the most art-loving and art-appreciating of mankind, and, if they owe the beginning of their arts to Chinese teachers, there is a single branch that they have not thoroughly made their own—to an extent indeed that origins are in most cases established by histo knowledge, rather than immediate similarity.

Politically, besides China proper, *i.e.* " the eighteen provinces," C rules or exercises suzerainty over Chinese Turkestan, Mongolia, Tibet. Here we shall only consider ethnic China, bounded for prac purposes on the north by the Great Wall, and, where this leaves of the Gobi Desert. In the west is the mountainous Tibetan border, in the south-west to the Gulf of Tonking the boundary is political ra than natural.

Historically we know nothing of the origin of the Chinese, thoug already stated, in Kansu and Honan there have been found buria neolithic and transitional (chalcolithic) date of a people who were thern Chinese in physical characters but differed culturally from al all that we know of Chinese culture. These folk may date to some B.C., whereas the earliest Chinese (An Yang) culture, ivories, etc., ca in the style of the Chou dynasty, dug up in the neighbourhood of site, may be taken to be nearly a thousand years later. Too much im ance must not be attached to these dates; that of the Kansu buria speculative, moreover these pre-Chinese burials and An Yang are graphically far apart.

In any case, the old civilisation of China is first known in the valle the Hoang Ho—the Yellow River—and here, in Northern China, is home of the rather tall, often burly, Chinese, who, unless their type altered within the last two to three thousand years, started China on voyage of pre-eminence in Asia and were the originators of those derful bronzes and porcelains which the name of their country cal our minds.

These northerners are stoutly built men, with an average statur about 66 in., mesaticephalic rather than brachycephalic, though not commonly described as round-heads. They vary greatly in facial cha ters; long faces and noses with high bridges are not uncommon, n the eye always Mongolian. They may be presumed to carry a substa amount of foreign blood; Tungus, Turki, and Mongols from beyond Wall have entered Northern China over and over again, and, thoug ways absorbed into the Chinese nation, have doubtless modified type.

This great historical civilisation spread into Southern China along tributaries of the Yangtsze, but did not greatly affect the folk inland its southern bank until the last centuries of the last millennium ore this we must picture the southern Chinese as leading a somewhat nitive agricultural life, indeed the quality of the culture they held at time may be fairly well judged by that of the fast diminishing group o-called "aborigines" of the Southern Provinces—the Man, Miao, —who again differ little from the folk of Indo-China and even the i of Burmah.

he southern Chinese, whose physical characteristics are less well-wn than those of their northern brethren, are considerably shorter, e round-headed, and rather darker-skinned. We may put their height bout 63–64 in., their cephalic index as somewhat over 80, and that the back of the skull often shows considerable occipital ening.

he Manchu in China have so intermarried with the Chinese that it ns doubtful whether they can be differentiated physically, and even ne north beyond China proper the Manchu are a little-known people. y have mixed much with Chinese and latterly there has been Japanese nigration; the figures given are often discrepant, and Buxton argues necessity for search for an old Manchu type in the remoter parts of nchuria.

he "Turki" Moslems of Kansu are regarded by Buxton as an Alpine-ow race cross, and probably have much Turki blood; they are of vier build than the ordinary Chinese and more turbulent. Besides e "Turki" Moslems there are "Arab" Moslems in Peking, form-a distinct community dating back to the founding of the city by Yung (reigned 1403–1425). They are sufficiently good Moslems to avoid and this, in China, implies that their marriages are limited to their community.

spite of limits of space, something must be said about the tempera-t and character of the Chinese, so different from that attributed to by the uninstructed layman. Their outlook indeed is as far as may om the inscrutable, unemotional, silkily subtle quality which Western —and especially Western fiction of the cheaper sort—attributes to . It is only necessary to watch a group of Chinese coolies seeking ire, or a crowd brought together by a street mishap, or even labourers eir work, to be convinced that the Chinese are more excitable and ional than north Europeans. In private life the same excitable cter is shown by the very emotional conduct which is common after y quarrels, and the frequency on such occasions of severe hysteria uicide, while with regard to the suggestibility of Chinese crowds it ficient to refer to the history of the Boxer Rebellion.

is is not to say that the "superior man" of Confucius does not exist; is still a considerable number of men who have trained themselves ntrol their emotions in true Confucian fashion; nor indeed are such d to the older-fashioned *literati*. But their number is relatively and the mass of Chinese are at least as emotional as the corre-ling classes in Great Britain or the United States. Perhaps the diplo-—even if he was mythical—who called the Chinese the "British East" was not far wrong. It is at least a pretty, and we may hope terly unfounded, compliment to two peoples, even if one essential ence in outlook be kept in mind. The Chinese has never admired the fighting man as such, his heroes are not soldiers, and if in his soldiers have earned distinction it was for administrative rather t fighting virtue. So his poems are not epics, nor are his love romance Western erotic type, for his whole outlook on womankind is as diffe as may be from that of the mediæval and Renaissance Europeans have so largely moulded our tradition.

The Jews of China are of historical interest only. They are now assi lated, but at one time they formed a small but definite element at Kai and had a synagogue.

In a concise description such as this, Tibet, Mongolia, and Manch are conveniently, if somewhat irregularly, considered as Chinese bor lands, and indeed in all these regions Chinese influence has existed for last 2,000 years or more.

Tibet is officially so connected with China that it is symbolised by of the five stars in the flag of the Republic. Little is known of the cou anthropologically, but we have already referred (p. 443) to the presenc old Caucasian blood. Further, two types can be recognised; one lo headed, the so-called "Warrior" type, the other round-headed, "Priestly" type, though as might be expected both types are fo among the priests, and moreover, in Northern Tibet Chinese influe has been potent for generations, bringing with it no doubt consider Chinese blood.

The Mongols, who have given their name to the numerically stron of the human races, have their home in a huge, sparsely inhabited cou to the north of China. Very little is known about them anthropologic but, after examining the available evidence, Buxton concludes "there seems to be an underlying homogeneous element among people who claim to be Mongols; this is probably, especially on borders, mixed with other strains, but is essentially different f Yellow or Mongoloid man. Their territory has been invaded by Yel man, who has at times mixed much with the population, and to- often exists in groups within Mongol territory, but is always physic and culturally distinct. The Mongols are connected by blood with so branch of Alpine . . . man."[1]

South-east of China lie Tonking, Annam, Cochin China, and Ca bodia (constituting French Indo-China), Siam and Burmah. It is proba true that over all this area, and especially in Indo-China, the domin type is one akin to the "aborigines" of Southern China, and we r regard these "southern aborigines," if we may call them so (omitting the moment pre-Dravidians and Negritos), as having been modi locally by strains of Negrito, Tibetan, Nēsiot, and even Caucasian blo *via* the Tibetans. Farther south, in the Malay Peninsula, besides Mal there are Semang (Negritos), Sakai (pre-Dravidians), some primi proto-Malays (Besisi and Jakun) and immigrant Chinese.

The Malay proper, the true Malay of history, who distinguish the selves as the Orang-Maláyu, are Muhammadan and speak the langu

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[1] *Op. cit.*

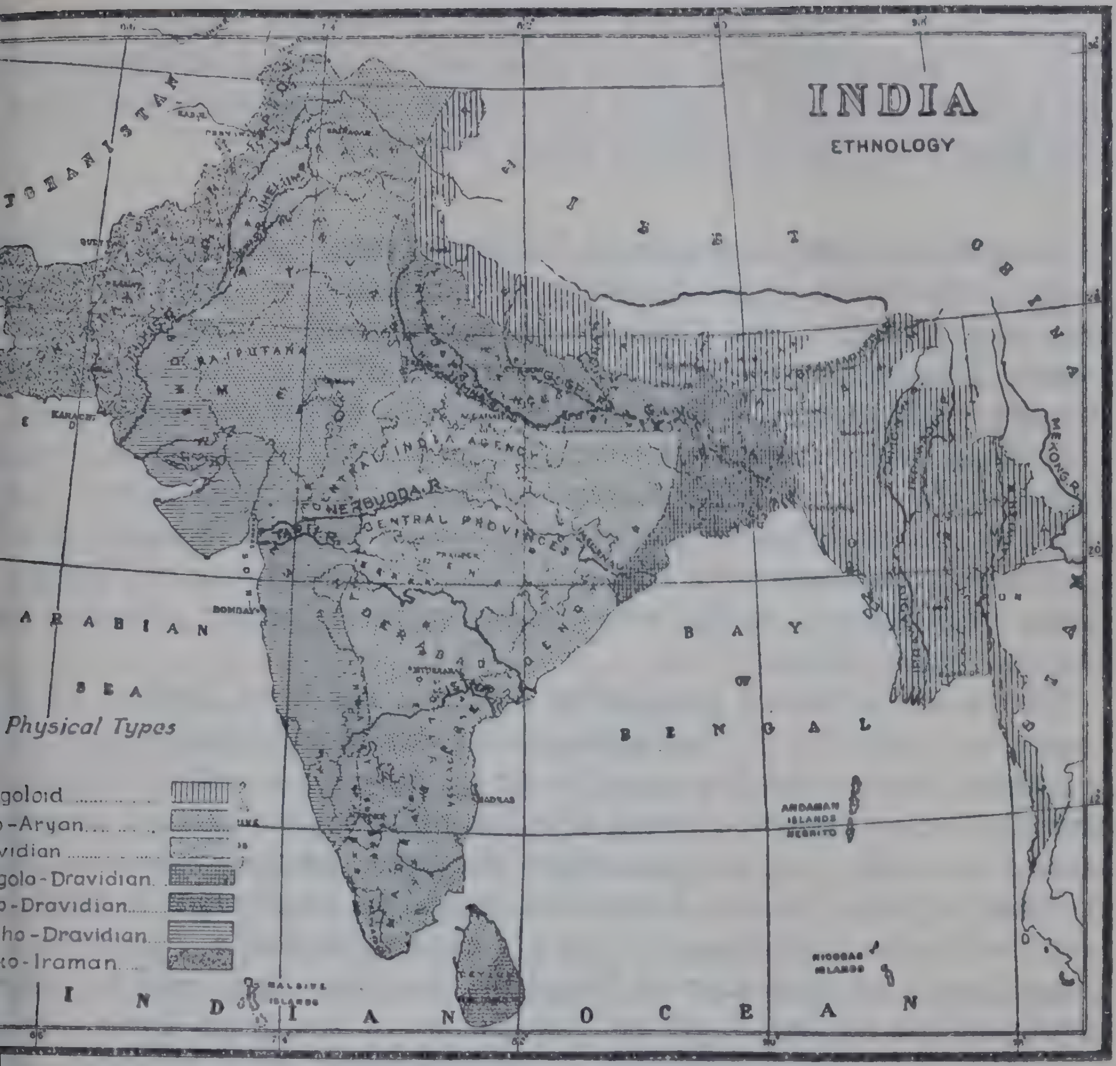

Fig. 5.—RACES OF INDIA (AFTER RISLEY)

is called Malay. They appear in history about the middle of the fth century, originating as an obscure tribe which rose to power in Ienangkabau district of Sumatra. At this time was founded their first ny, Singapore ; its name, which is pure Sanscrit, signifying the " Lion " is an indication of the strength of Hindu influence in the Archi- o at that time. Menangkabau was the first Moslem state to acquire ical supremacy, and " this district thus became the chief centre for ater diffusion of the cultured Malays, their language, usages, and on, throughout the Peninsula and the Archipelago. Here they are l in compact masses chiefly in south Sumatra ; in all the insular ps between Sumatra and Borneo ; in the Malay Peninsula as far as the Kra Isthmus, here intermingling with the Siamese . . . partly lhists, partly Muhammadans ; round the coast of Borneo and about stuaries of that island ; in Tidor, Ternate, and the adjacent coast of ; in the Banda, Sula, and Sulu groups ; in Batavia, Singapore, and e other large seaports of the Archipelago. In all these lands beyond tra the Orang-Maláyu are thus seen to be comparatively recent ls ; and in fact intruders on the other Malayan populations, with they collectively constitute the Oceanic branch of the Mongol on."[1]

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[1] Keane : *Man, Past and Present* (1920).

It is these “ other Malayan populations ” which constitute the gr mass of “ proto-Malays,” whose most highly civilised members, such the Javanese, practise a culture largely derived from India and differ *t* *cælo* from the rude up-country tribes of Borneo.[1]

Geographers sometimes divide India into three great areas (the Dec in the south, north of this the plains of Hindustan, and then the Himal and their foothills), but these do not correspond to natural ethnic p vinces. The anthropology of India is in fact difficult, and our knowle is quite inadequate. We may assume that the oldest population was p Dravidian, whose representatives, the primitive hunting jungle tribes India (in the Deccan Irula, Kuramba, Paniyan, etc.) and Ceylon (Vedd still exist. It is probable that such primitive hunters formerly exten over the greater part of India, and though the existence of Negritos never been proved in the sub-continent, their former presence in Deccan seems likely.

The more advanced population of India has been divided by Ris into seven great groups, and although his classification has been criticis it cannot be said that the types he set up have been seriously impugn though it may fairly be urged that his nomenclature is not always f tunate (*see Fig.* 5). Risley describes his types, passing from the west frontier of India ; in our description it will be convenient to start in south with the Dravidians, a very old element in India. Apart from p Dravidians and hypothetical Negritos, the Dravidian may be taken represent the ancient civilised population of much of India, its di tion with pre-Dravidians and its modification by Caucasian Ary speaking and Mongolian elements producing the Indians of the pres day.

The *Dravidian* type extends from Ceylon to the valley of the Gang pervading the whole of Madras, Hyderabad, the Central Provinces, m of Central India, and Chota Nagpur. Among its most characteristic presentatives are the Paniyans of the South Indian hills and the San of Chota Nagpur. The stature is short or scarcely medium ; the co plexion very dark ; the hair shows tendency to curl ; eyes dark ; h long, and nose very broad.

The *Mongolo-Dravidian* type, found in Lower Bengal and Orissa, co prises the Bengal Brahmans and Kāyasths, the Muhammadans of East Bengal, and other groups peculiar to this part of India. They are to regarded as a blend of Dravidian and Mongolian elements, with a str of Indo-Aryan blood in the higher groups. Stature medium, complex dark ; hair on face usually plentiful ; head broad, nose medium wit tendency to breadth.

The *Aryo-Dravidian* type, found in the United Provinces of Agra a Oudh, in parts of Rajputana, in Bihar and Ceylon, is represented in pper strata by the Hindustāni Brahman, in its lower by the Chamār egarded as arising from the intermixture of Indo-Aryans and Dravi- ans, the former element predominates in its lower groups and the latter its higher. The stature is medium ; the complexion varies from lightish own to black ; the head is long, with a tendency to mesaticephaly ; the se ranges from medium to broad.

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[1] By continental writers the inland (pagan) tribes of Borneo are known Dyak ; in this country the term is commonly limited to a particular tribe, Orang-Iban, the so-called Sea Dyaks, though there also exists a numerica weak and insignificant tribe termed Land Dyaks. As to Indian influence, i worth remembering not only the ruins of Borobodur, but that Bali is still ministered(under Netherlands authority) on the model of a Hindu rajarate.

The *Scytho-Dravidian* type of Western India, comprising the Marātha rahmans, the Kunbis and the Coorgs, was thought by Risley to have isen as a mixture of Scythian and Dravidian elements. There is really evidence for the identity of the round-headed group, who must how- er fall within the Alpine race. Hair on head rather scanty ; stature edium ; complexion fair ; head broad ; moderately fine nose, not nspicuously long.

The *Mongoloid* type of the Himalaya, Nepal, Assam and Burmah, is presented by the Kanets of Lahoul and Kulu, the Lepchās of Darjeel- g, the Limbus, Murmis and Gurungs of Nepal, the Bodo of Assam, d the Burmese. Stature low or medium ; skin of varying tints of yel- wish brown ; head broad, with face characteristically flat ; nose fine to oad ; eyelids often oblique ; facial hair scanty.

The *Indo-Aryan* type occupies the Punjab, Rajputana and Kashmir, ving as its characteristic members the Rajputs, Khatris and Jats. This pe most nearly approaches that traditional for the Aryan-speaking lonists of India. The stature is mostly tall ; complexion fair ; hair on ce plentiful ; eyes dark ; head long ; nose narrow and prominent.

The *Turko-Iranian* type is represented by the Baloch, Brāhui, and ghans, of the Baluchistan Agency and the North-West Frontier Pro- nce. Risley writes of these peoples as " probably formed by a fusion of rki and Persian elements in which the former predominate,"[1] but ere is also an Armenoid strain. Stature above mean ; complexion fair ; es mostly dark, but occasionally grey ; hair on face plentiful ; head ad ; nose medium, prominent, not infrequently Armenoid.

Perhaps the most important of the objections that have been raised is t the broad-headed element in Risley's Mongolo-Dravidians and ytho-Dravidians is due to an admixture of the Pamir type of the Alpine e. This is no easy matter to settle ; it can only be said that the origin the Mongolo-Dravidians has been critically examined by Buxton,[2] h the result that he supports Risley's thesis, while the profile of some ngali faces can scarcely fail to convince that at least some Mongolian od is present. With regard to the Scytho-Dravidians, we have sug- ted above an Alpine element, while as to the historical Scythians, at little we do know scarcely indicates that the Scythians reached India ny mass.

The caste system, which in India has acquired a rigidity unparalleled where, implies the existence of a large number of endogamous groups, members of which are bound together by a common traditional upation and belief in a common origin. By this system the whole rse of a man's life—how he shall eat, drink, dress, marry and give in riage—is irrevocably determined by the accident of birth. The political significance of caste is therefore immense, and whatever its fects it does ensure an amazing continuity in tradition and in the arts crafts, while on the ethnic side it cannot but play an important par fixing physical type.

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[1] *The People of India* (1908).

[2] *The Peoples of Asia* (1925).

The original significance of the word *varna*—“ caste ”—was doubt that implied by “ colour,” as denoting purity of breed. In the *Instit* of Manu (compiled between the fifth and second centuries B.C.) a sepa origin is ascribed to each of the four classes into which the commu was divided, which later became the four traditional castes, *viz*. the Br man (priestly), Ksatriya (warrior), Vaisya (merchant), and Sūdra (cu vator and menial).

At the present day Risley distinguishes seven different types or v eties of caste. First the tribal, *e.g.* the tribes of Chota Nagpur and Nagas ; secondly the functional or occupational, perhaps the most fami to Europeans and often regarded as the chief factor in the evolutio caste ; the third type is sectarian, *e.g.* the followers of a popular refor outcast themselves and very soon form a new caste ; a series of new ca may be formed by the crossing of one with another, and Risley give a fifth type the “ national castes,” such as the Newars—once the dominant race in Nepal—or the Marāthas. Caste may also be forme migration, where a group outcasts itself by moving and forms in its home a new caste, and finally certain castes may have arisen from cha of custom as, for example, the Rajput and the Jāt.

If we seek to speak of an Indian temperament we can only say that old speculative Hinduism, with its mystical systems of religion and ph sophy which we call Brahminism, was no doubt introvert, but how introversion was the preponderant disposition among the upper cla generally, and whether it still plays as important a part in modern H duism as it did of old, is another matter, though the history of Buddh certainly suggests that it may. This system, arising as a protest aga the mystical formalism and particularism of Brahminism, althoug made headway against Brahminism for centuries (partly no doubt cause its sects made no difficulty in accepting, in mild disguise, muc the old mystic philosophy) and numbered millions of converts, yet at present day is extinct in India. It may be added that caste, with its pre and unalterable determination of every man's position in the social fab seems to be just one of those examples of “ arrangement ” which ar typical of the introvert disposition.

AFRICA

In broad outline, the ethnology of Africa is so much simpler than of the other continents that, in spite of vast unsurveyed areas and charted tribes, it is comparatively easy to write an account of its ra history. It is true that classification, or at least delimitation, has been largely based on linguistic criteria, for the facts of language are relati easily determined, and though in themselves no safe guide to race, ne theless in Africa speech and race do so substantially correspond in reg to the great racial groups that such terms as “ Bantu,” “ Semitic,” et

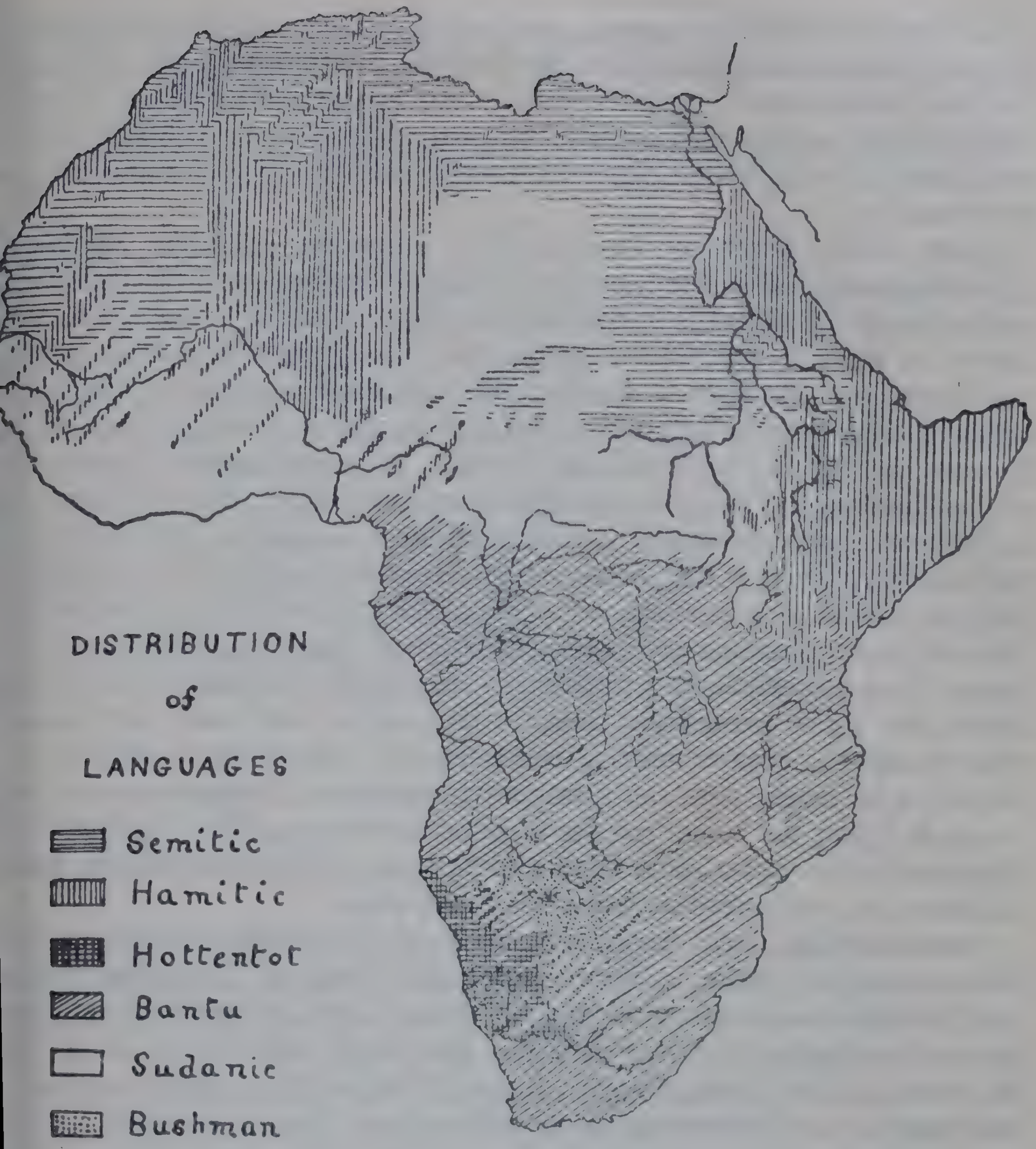

Fig. 6.—LINGUISTIC MAP OF AFRICA

ich, strictly speaking, have no more than a linguistic significance— habitually employed with a high degree of racial accuracy.

The main divisions of mankind in Africa are as follows :—

Bushmen
Hottentots } sometimes known as Khoisan
Negritos
Negroes
Hamites
Semites

t must, however, be remembered that the Semites—apart from a cer- amount of mixture in Abyssinia—have only been in Africa a little re than a thousand years, and their influence has in the main been fined to the country north of the Sahara.

f these divisions the Hamites, Negroes, and Bushmen are by far the st important.

In considering the movements and mixings that have gone on in Afric it is well to remember that there are no great mountain ranges to obstru the free movements of peoples, but deserts in the north (and to a limit extent in the south) with tropical rain forest in the west, though that the edge of the Abyssinia plateau is hardly sufficiently broad to constitu an obstacle.

Apart from relatively late Semitic influence—whether Phœnici (Carthaginian) and limited, or Arab (Muhammadan) and widely diffus —the history of Africa is in the main the history of the Hamites, with t record of their interactions with the two more primitive African stoc the Negro and Bushman, whether this influence was exerted by high civilised Egyptians or by such wilder pastoralists as are represented at t present day by the Beja and the Somali. To emphasise the importan of the Hamites and the part they have played in Africa, it is only necessa to look at a map showing the distribution of languages in Africa at t present day, when it will be seen that Hamitic languages are spoken peoples spread over perhaps one-fifth of Africa (*see Fig.* 6). The area i habited by people regarded as Hamitic is even larger, including, as it do many tribes superficially semiticised through the influence of Islam, a before the Arab expansion Hamitic languages must have been spok over by far the greater part of the northern half of the continent. It necessary to realise that the number of immigrant Arabs was never ve great, and that the social results of intermarriage and the prestige of t dominant religion, far more than a substitution of Arab for Berber blo accounts for such arabisation as has taken place.

Ethnologically, then, Africa may be divided into two sections, the n thern essentially white or light-skinned, inhabited by Caucasian Hami and Semites, the southern essentially Negro, with peoples almost ever where characterised by their dark skin and woolly hair. A line drawn fr the mouth of the Senegal River, through Timbuktu to Khartum, the southwards and westwards to the Abyssinian border at about 12° following the Abyssinian border to the Juba River and Indian Oce marks out the northern boundary of the Negro with fair precision, it must be realised that the term Negro includes at least three huge grou each with its peculiar characteristics. Almost everywhere in this vast a the Negro carries Hamitic blood and has been influenced by Hami culture. The true Negro is mainly confined to West Africa, while the r of negro Africa consists of Negroes hamiticised to a varying extent— the one hand the Bantu, on the other the Nilotes and half-Hamites.

The Hamites—who, as already stated, belong to the Mediterran race—are commonly divided into two great branches, eastern and n thern, and their cradle-land is generally agreed to be Asiatic, perh Southern Arabia or possibly an area farther east, though Sergi sugge the Horn of Africa. There is no doubt that the Hamites and Semites m be regarded as modifications of an original stock, and that their diff entiation did not take place so very long ago, evidence for this statem being furnished by the persistence of common cultural traits and linguis affinities. Physically their relationship is obvious, as also their kins with the European representatives of the Mediterranean race, thou

›me anthropologists admit this relationship only for the Northern
ranch of the Hamites, proposing to distinguish these from the Eastern
anch by the term " Libyan."

To the Eastern Hamites belong the ancient and modern Egyptians, the
eja, Berberine (Barabra or Nubians), the Galla, Somali, Danakil, and,
ough mixed with Semites and Negroes, most Abyssinians.

The Northern Hamites include the Berbers of Tripoli, Tunis and
lgeria (often conventionally distinguished as Libyans), the Berbers of
lorocco, the Tuareg and Tibu of the Sahara, the Fula of Nigeria, and
e extinct Guanche of the Canary Islands.

Apart from a few skeletal remains, referred to the Old Stone Age, the
dest " Africans " of whom we have any organised knowledge are of the
eat group of Eastern Hamites.[1] These are the pre-dynastic Egyptians
roto-Egyptians, anterior to about 3200 B.C.), whose burials leave no
ubt as to their identity with the Beja of the eastern Egyptian desert, to-
y the purest representatives of the Hamitic race. This is well brought
it by comparing stature and cephalic index of the proto-Egyptians and
two modern Beja tribes, and is of extreme interest, implying as it does
stability of type for a period extending for some 6,000 years.

		C.I.	*Stature*
Beja	Ababda	73·7	64 in.
	Beni Amer	74·7	64½ in.
Proto-Egyptians (Naqada)		74·9	64 in.

Nor in this matter are we limited to physical measurements. We have
o notable representations of the proto-Egyptians as they were in proto-
nastic times 5,000 years ago and again in the twelfth dynasty about
oo B.C. The first of these is the head of an ivory figure (*see Fig.* 7*a*)
ınd at Hierakonopolis. It is only necessary to compare this, with its
aight nose, well-modelled lips, and slight beard, with the photograph
the Beni Amer (*see Fig.* 7*b*) to see the likeness. The twelfth dynasty
ample comes from Meir, where on the west bank of the river, and some
o miles south of Cairo, is a group of twelfth dynasty tomb-chapels
ting to about 2000 B.C. On the walls of one of these there is a wonderful
wing of a Beja herdsman (*see Fig.* 7*c*), undoubtedly one of the most
ccessful examples of racial portraiture of the Ancient Egyptians. The
g thin figure and limbs, with broad chest, narrow flanks, and almost
racted abdomen, are no doubt conventional and exaggerated represen-
ions of the characteristics of the pastoral desert men as they appeared
he agricultural Egyptians, but there can be no criticism of the splendid
uralism of the lined face, the thin pointed nose and the mop of hair
jecting over the forehead, and standing out stiffly over the whole head
he nape of the neck. The beard is the usual chin tuft of the Beja tribes.
lance shows the close resemblance, even to the hairdressing, to the
dendoa whose head (*see Fig.* 7*d*) is sketched from photographs taken
r Port Sudan.

This ignores Mr. Leakey's recent important unpublished discoveries in
Africa; his preliminary announcement indicates that the Upper Palæolithic
ıbitants of the Kenya plateau were not Negroes.

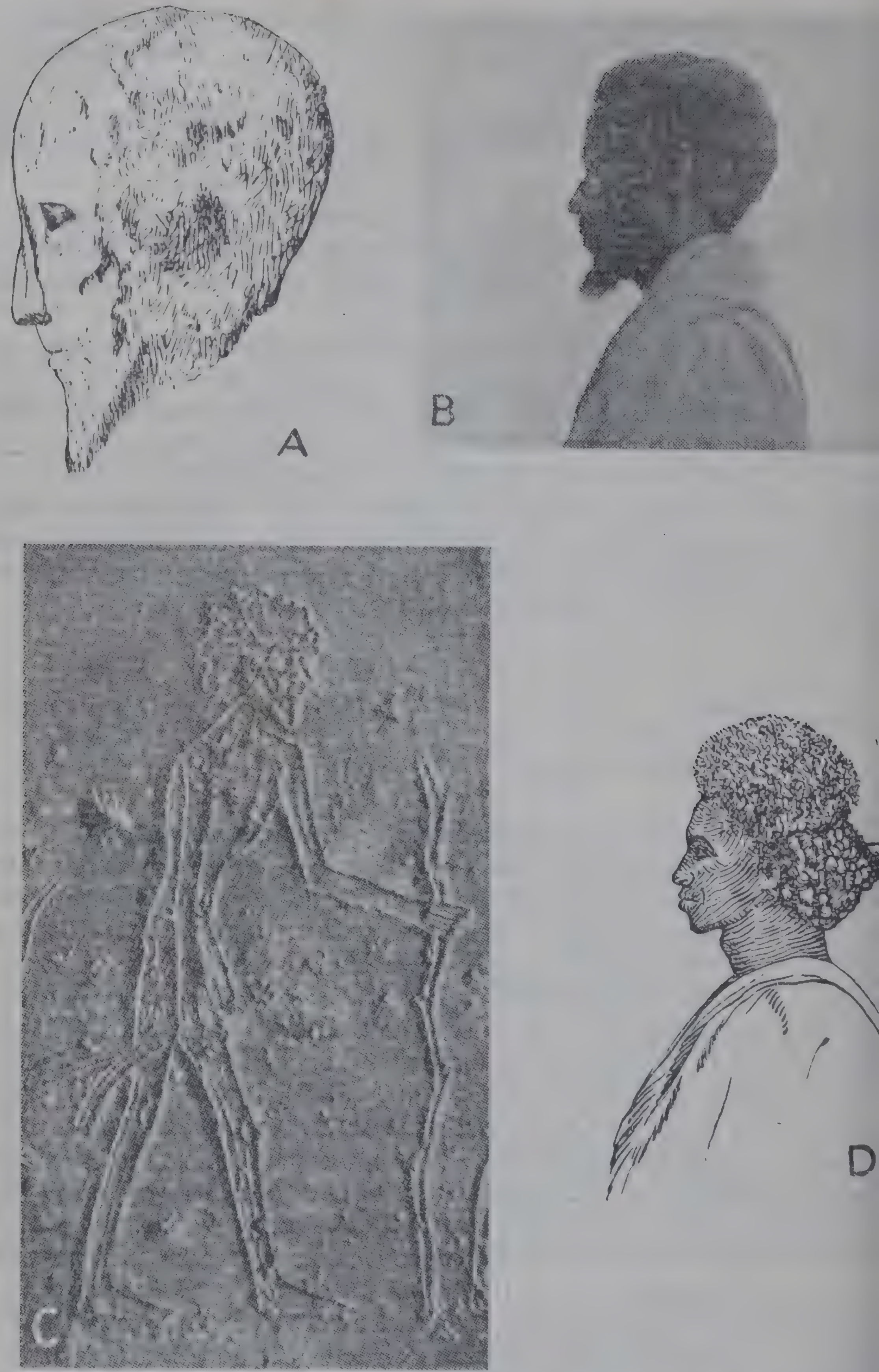

Fig. 7.—PERSISTENCE OF PROTO-EGYPTIAN TYPE IN NILE VALLEY

A. Ivory Head, Hierakonopolis at 3000 B.C. B. Modern Beja (Beni Ame
C. Wall painting (Meir 2000 B.C.). D. Modern Beja.

The Northern Hamites are typically represented by the Berbers, who re skilled agriculturalists and gardeners, while many are pastoralists as vell. Their social organisation differs entirely from that of the Arabs, eing as essentially democratic and suited to a sedentary life as that of he latter is aristocratic and apt for a nomadic existence, though it must be ealised that this typical contrast is not absolute, and that in North Africa here are many sedentary Arabs and some nomad Berbers, the Arabs pre-enting a diminishing percentage of the population from east to west. 'he Berbers are good craftsmen, and the silver jewellery of Algeria is haracteristic and distinctly beautiful, while their pottery shows an inter-sting resemblance to that of the proto-Egyptians.

The Arab conquest of Egypt in the years 639 to 641, although important ulturally, cannot, owing to the small number of immigrants, have had ny great ethnic effect on the population of the Nile Valley. It was the reat invasions of the eleventh century, and especially the migration of the eni Hillal and kindred tribes, that led to the effective arabisation of 'orth Africa and to the dominance of Islam. For in Africa, as elsewhere Islamic lands, creed counts for more than race, and the name " Arab " applied to any people professing Islam, however much Negro or other reign blood may run in their veins, so that, however great its cultural lue, the term is of little ethnic significance and often is frankly mislead-g. Yet in a broad sense, and excluding the Berbers, the term remains of ositive value as denoting a vast series of tribes, claiming, even if they ve it not, a predominant Caucasian ancestry, boasting a particular storic tradition and religion, and speaking a Semitic language. In this nse the peoples we call Arab contrast with all the other Africans we ve discussed in that they exhibit an essentially uniform culture, even in many instances they can boast but little of the newer immigrant ood to which this culture is attached.

The Arabs of Africa may be divided into three main cultural groups : e nomads (" people of the camel ") ; Baqqara (cattle folk), semi-mads ; sedentaries. Actually some tribes, such as the Kenana of the glo-Egyptian Sudan, include all three classes, and many nomad tribes e sedentary sections, while there may be a limited nomadism, as when ribe sows its crops in an oasis in the autumn and leads a more or less ndering life until the spring. Tribal organisation is far stronger among nomads than among the sedentaries, and it is among the former that purest Arab physical type is found, *e.g.* among the camel-owning babish of the Anglo-Egyptian Sudan or the Aulad Ali of Eastern poli. Even here there is considerable variation, largely determined by wealth of the tribal sections and the consequent amount of black slave od.

'hough the Negro is no doubt one of the oldest stocks in Africa, no gro skulls of any great age have yet been discovered. The antiquity of race is, however, indicated by one of the great proto-Egyptian slate ttes, dating from *circa* 3200 B.C., which depicts captives and dead with lly or frizzly hair and showing the same form of circumcision as is practised by the Masai and other negroid tribes of Kenya Colony ; eover, the Archæological Survey of Nubia has brought to light a burial—with typical Negro hair—dating to the Middle Kingdom (ab 2000 B.C.).

The true (West African) Negro, whose physical characters are d cribed on page 445, possesses certain characteristic cultural features. T build gable-roofed huts; their weapons include bows, tapering at ea end, with bowstrings of vegetable products, swords and plaited shiel but not clubs or slings; among musical instruments are wooden dru and a peculiar form of guitar—the so-called West African harp; clo ing is of bark-cloth and palm-fibre, not of skin; secret societies, ma and wood-carvings of the human figure are characteristic; cattle absent, the domestic animals being the dog, goat, pig, and hen; can balism occurs, and human sacrifice—formerly common—might att a huge scale, as in Ashanti. On the artistic side, the West Afri Negro shows a skill in plastic art that is hardly found elsewhere in Ne Africa, the carved ivories, wooden and ivory masks, and bronzes Benin being specially noteworthy.

As already stated, the great part of Negro Africa is occupied by mi populations of hamiticised Negroes (though some of the members of Bantu group carry but little Hamitic blood and show no great signs Hamitic culture). The origin of these Negro-Hamitic peoples will understood when it is realised that the incoming pastoral Hamites arri in a long succession of waves, of which the earliest may have been remote as the end of the Pluvial period. Better armed than the agric tural Negroes among whom they settled (there was no Bronze Age Africa, and the Negro, now an excellent iron worker, presumably lea this art from the Hamites), they would soon assert their superiority o the latter. Gradually a series of peoples combining Negro and Ham blood arose; these, superior to the pure Negro, would be regarded w disdain by the next incoming wave of Hamites, and be pushed farther land to play the part of an invading aristocracy *vis-à-vis* the Negroes whom they impinged. This process was repeated over a long period time, the agriculturalists always dominated by the pastoralists and te ing to leave their own mode of life in favour of pastoralism or to comb the two. The result of one such series of combinations is to be seen in Zulu, another in the Baganda, while an even more striking exampl afforded by the symbiosis—to use a biological term—of the Bahima the Bahero. The Bahima, a tall cattle-owning aristocracy with narr nose and long faces (though they always have Negro hair), are utterly like the shorter, broader-faced, Negro Bahero in whose country they and who normally provide them with grain.

It is not surprising that classification is difficult, and the observe compelled to fall back on the relatively easily determined facts of langu With this reservation the following may be regarded as the prim divisions :—

(1) The half-Hamites, inhabiting East Africa and East Central Af from the neighbourhood of Lake Rudolph in Kenya to 5° or 6° in Tanganyika Territory.[1]

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[1] These are sometimes called Nilo-Hamites, a thoroughly inappropriate t since there is no evidence to suggest that they arose from a mixture of Nil and Hamites, nor that they are Hamites living on the Nile south of Khartu

(2) The Nilotes of the Nile Valley, extending from the Anglo-Egyptian udan into Uganda.

(3) The Bantu, a congeries of peoples occupying the southern two-hirds of black Africa, roughly delimited by a line running irregularly om the Rio del Rey to the mouth of the Juba River.

The half-Hamites, as the term implies, carry a considerable amount f Hamitic blood, *i.e.* definitely more than the Bantu and Nilotes. The elative preponderance of the Hamitic side of their ancestry is reflected ike in speech, appearance and culture. They all speak languages of amitic type, and although dark-skinned their faces are generally Negroid ther than Negro. Culturally they are predominantly pastoralists, many their tribes leading the semi-nomadic life which this entails. The andi, Masai, Turkana, and Suk are perhaps the best-known tribes of is group.

The second great group of hamiticised Negroes are the Nilotes, a ell-defined physical type, speaking Sudanic languages and associated ith a particular culture, who occupy the Nile Valley from some 200 iles south of Khartum to Lake Kioga, one group reaching Lake Vicria. The majority of Shilluk—who, with the Dinka, may be taken as the ost typical representatives of the Nilotes—are obviously Negroid rather an Negro, while in spite of their dark skins and no doubt preponderatly Negro blood the Nilotes are culturally far more Hamitic than Negro, eir predominant pastoralism being reflected (as in the half-Hamites) in e almost religious esteem in which they hold their cattle. Human crifice is very rare and cannibalism unknown, in contradistinction to eir neighbours on the other side of the Nile-Congo divide. The men r the most part go naked. Psychically the Nilotes show an aloofness and ide of race, with a lack of desire for European clothes or trade objects, ich is probably unparalleled elsewhere in Africa.

The Bantu are a congeries of peoples named from and defined by the culiar type of language they speak, which is generally considered to have ginated in the neighbourhood of the Great Lakes. Apart from the ions grouped round the shores of the Great Lakes (Baganda, Bakitara, .), where the Hamitic invaders from the north have mingled less comtely with the older inhabitants, the infusion of Hamitic blood which ferentiates the Bantu from the pure Negro is strongest in the east and th, weakest in the west and north.

he Bantu may be divided into three main groups : Southern Bantu, abiting the vast region south of the Zambesi and Kunene Rivers ; stern Bantu, reaching from the Kunene River in the south to the Rio Rey (separating Southern Nigeria from the Cameroons) in the north from the Atlantic to the Rift Valley (line of the Great Lakes) in the ; Eastern Bantu, stretching from Uganda in the north to the Zambesi he south.

he Southern Bantu comprise the Shona peoples, the Zulu-Xosa (inling the so-called " Kaffirs " and the Matebele), the Suto-Chwana hwana, Basuto, etc.), and the Herero-Ovambo ; they are grouped a very large number of tribes showing great diversity in physical acters.

he area of the Western Bantu includes the true " Heart of Africa," the tropical rain forest of the Congo, the home of such little-known bea as the okapi, and of pygmy hunting tribes with habits and beliefs of whi we are almost entirely ignorant, but it also includes (or included) t territory of considerable and highly organised kingdoms, such as t mediæval kingdoms of the Kongo and the Balunda, and in later times t Bushongo Empire, as well as such renowned cannibals as the Fang. T southern limit is vague, the Lunda Empire and Jaga raids, with subs quent encroachment of wandering tribes, having played havoc w tribal organisation.

Of the Eastern Bantu, the Lacustrine tribes, as already mentione present a more recent Hamitic element than that which originally ga rise to the Bantu; indeed, among the Banyankole assimilation betwe the two stocks has scarcely gone beyond the possession of a comm language, spoken alike by the intruding Bahima and the indigen Bahero.

Apart from the Lacustrines the Eastern Bantu include such we known tribes as the Akamba and Akikuyu, essentially agriculturalists, though cattle are even here regarded as the embodiment of weal Among these tribes there is, strictly speaking, no chief, but governme is in the hands of a council of elders, with only local authority, a ma position in the community being according to the seniority of his a grade. The Wachagga on Kilimanjaro share with the Lotuko of the N Valley the interesting custom of exhuming the bones of their dead af some months, the skull being then taken to an ancestral shrine or posited in an earthen jar in the neighbourhood of the village. T Swahili of the east coast are specially important, as their language become the *lingua franca* of a great part of East Africa.

The Bushman is distinctive in appearance from all other Africans s only the Hottentot, and belongs to a type so ancient that he may well h been in Africa for a period to be measured in tens of thousands of yea while until less than a century ago he was using stone tools of the t that was being made in Europe towards the end of the Old Stone A It is generally agreed that the Bushmen reached their present home South Africa from the north, their ancestors having perhaps occupied great part of tropical East and East-Central Africa, while the former tension of the race over practically the whole of South Africa is shown the distribution of its relics—skeletal remains, rock paintings, and e place-names. Apart from isolated offshoots, their present range is stricted to the Kalahari Desert and the northern half of South-W Africa, where alone their original mode of life has been retained.

The Bushmen lead a primitive nomadic life as hunters and fo gatherers, their social organisation and culture being of the most sim The southern Bushmen are notable for the paintings and engravi which in the past they executed on the walls of caves and rock shelte The paintings, many of which are of comparatively recent date, naturalistic studies of high artistic merit, depicting animals, cattle-ra dances, and magico-religious scenes in which animal-headed hu figures are represented. This art seems to have completely died out.

The Bushmen are rapidly becoming extinct. Even before the arri of the white man in South Africa they were being forced out of their unting-grounds by their stronger Bantu and Hottentot neighbours, and he white colonists continued the process of dispossession and destrucion, until the ancient owners of the land, unable or unwilling to adapt hemselves to their changed environment—to domesticate animals or ultivate the soil—were reduced to a few scattered and dwindling emnants.

There is little doubt that the Hottentots are the result of the mixture f Bushmen and early invading Hamites, with an infusion of Bantu, and t is generally held that the mixed race arose in the north, perhaps near he Great Lakes, and did not reach South Africa until after the Bushmen. he former distribution of the Hottentots comprised practically the whole f the western part of South Africa from the Kunene River in the north the Cape Peninsula in the south, and extended inland to the Kei River. o-day, though scattered remnants are to be met with over a considerble part of this area, their tribal organisation is only found in a state of reservation in South-West Africa north of the Orange River. Like the ushmen, whom they dispossessed, they are now a passing people, and nly a remnant of their former customs survive. Culturally the outstandg difference between the two races is that the Bushmen are hunters and ood collectors only, while the Hottentots are a pastoral people, with erds of long-horned cattle and flocks of fat-tailed sheep ; they also differ om the Bushmen in practising the art of smelting iron, make wooden ots, weave baskets and mats from reeds and rushes, and make skin bags hold milk and water. Their material culture is, then, superior to that the Bushmen, but they do not appear ever to have possessed the art painting and engraving on rock at which the older and more primitive ce excelled.

Of the pygmy Negritos of Africa but little is known ; not only are we norant of their social organisation, but no one has yet discovered hether they have a language of their own, all recorded vocabularies longing to the speech of their Negro neighbours. Hunters, trappers d collectors, they are nowadays confined to the thick tropical forests thin 6° north and south of the Equator, but folklore and classical dition point to their having had a much wider distribution a few ousand years ago ; as long ago as the Pyramid Age (*i.e.* in the third llenium B.C.) the Pharaohs were sending south—but certainly not so south as the Congo Valley—for pygmies to dance before them.

t is not only among the islands of Farther Asia that the Oceanic ngols have travelled in their clumsy-looking but seaworthy craft : sing westwards, they reached Madagascar sufficiently long ago for early form of Austronesian (Malayo-Polynesian) to become the ndard speech, while the Antimerina, generally called Hova, a group ixteenth-century immigrants of fairly pure blood (perhaps originating ava), now form the dominant aristocracy of the island. The greater t of the population is negroid, and it seems natural to suppose that element is African, but considering that the language of Madagascar is an early form of Austronesian and the strong currents between Afri and Madagascar, as well as the facts that Madagascar culture is n Bantu, and that the latter are not seamen, there is much in favour the suggestion that the black element is also from the Far East, *i* consisted of Oceanic Negroids, who are known to be expert seame Immigrants from Arabia have certainly played an important part forming local dynasties, some arriving so early that, as reported, th recognised the patriarchs but not the Prophet.

In the south there has been immigration from India, and in the nor European pirates and slavers have left their mark; *e.g.* the man who co solidated the Betsimakara, one of the more important tribes, and provid them with a royal house, was a half-caste.

AMERICA

The Eskimo occupy the Arctic coasts of North America, Greenlar and extreme North-East Asia, and must be regarded as early immigrar of Asiatic type.[1] They are short (st. 62¼ in.) dolichocephals (C.I. 7 with broad flat face and prominent cheek-bones; nose narrow, mode ately prominent; eyes black and straight, but the epicanthic fold occasionally present.

The Amerinds (American Indians) occupy the rest of the New Wor it being understood that they have for the most part been exterminat in North America, and in the southern half of the continent are larg represented by mixed breeds. The hair is everywhere black, lank a coarse; skin colour yellowish-white to chocolate, usually some tint brown; stature varies but is generally high; skull generally mesa cephalic, but ranging from low dolichocephaly to high mesaticephal face usually broad, with high and laterally prominent cheek-bones; e brown, with sometimes a suggestion of Mongolian characters; nose oft well developed and straight, even aquiline in some northern stocks.

In spite of variation in appearance between groups, ethnologists generally agreed that there is an underlying general similarity of ty among the peoples of the New World which can only point to an origi common parentage. Further, since it is highly improbable on zoologi grounds that man originated on the American continent, this must ha been peopled either from the east or from the west, and the resemblar to the Mongolian type is so widespread that it seems certain that homeland of the American Indian was Asia rather than Europe; mo over, while there is no easy access to the New World from Europe, gap between Asia and North America *via* Behring Straits is only so forty miles.

This seems a simple conclusion. It is in fact so simple, considering complexity of physical characters and cultures found in the New Wor that some little elaboration is really due. Since, however, space forb ıy general discussion of all the lines of argument, it must suffice to anscribe the conclusions reached by Hrdlička and supported by Vissler :—

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[1] "It seems to be fairly well established that the Eskimo were the result migration of a special type into America at presumably a very early date. most representative appear to be those of the Hudson Bay district which wo thus be a secondary area of characterisation" (Haddon: *The Races of Man*

> " The American natives represent in the main a single stem or strain f people, one homotype ; this stem is identical with that of the yellow-rown races of Asia and Polynesia ; and the main immigration of the mericans has taken place, in the main, at least, gradually and by the orth-western route in the earlier part of the recent period, after man ad reached a relatively high stage of physical development and multiple condary differentiations. The immigration, in all probability, was a ribbling and prolonged overflow, likely due to pressure from behind, want, and a search for better hunting and fishing grounds in the rection where no resistance of man as yet existed. This was followed y multiplications, spread, and numerous minor differentiations of nguage due to isolation and other natural conditions, and by the devel-oment, on the basis of what was transported, of more or less localised merican cultures. It is also probable that the western coast of America, ithin the last 2,000 years, was on more than one occasion reached by nall parties of Polynesians, and that the eastern coast was similarly ached by small groups of whites, and that such parties may have cally influenced the culture of the Americans ; but such accretions have owhere, as far as we know to-day, modified the native population." [1]

It is not possible to state the date at which the ancestors of the American dian first entered North America—a date some 4000–5000 B.C. is rhaps plausible[2]—but this can be said, that no implements or other idence of early or middle palæolithic man (using the terms in a Western ropean sense) have been found in the New World, some of the so-lled palæoliths that have been produced from time to time being no ore than rejects, or rude or unfinished tools, while the skeletal frag-nts have not passed the test of skilled examination. There is, in fact, valid line of argument that when man first migrated into America he s other than neanthropic, or that his stone technique was other than imple form of stone chipping. But this need not imply very recent or, sometimes stated, a neolithic immigration ; the variety in language l physical characters in America can only point to a prolonged period physical differentiation.

Linguistic considerations point in the same direction. All American guages yet studied are morphologically akin ; they all belong to the olysynthetic " group—that is to say, languages that permit of a whole tence being included in a single polysyllabic word—not one true mple of which is found anywhere in the eastern hemisphere, where Basque, Caucasus, and Ural-Altaic groups limit incorporation to pro-ninal and purely relational elements. It is clear that a system so apart n all the conditions found elsewhere must imply a long development and consolidation, and the time is also demanded by the vast numb of stock languages prevailing throughout the continent, all differi profoundly in their vocabulary, and in fact with nothing in comm except this extraordinary polysynthetic groove in which they are ca There are probably about seventy-five stock languages in North Ameri of which fifty-eight occur north of Mexico, indeed it has been sta that there are as many linguistic stocks in America as in the whole of Old World. Moreover differentiation within a stock is very great, a the dialects usually as mutually unintelligible as, for example, Engl and German.

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[1] Clark Wissler : *The American Indian* (1922).

[2] At the other extremity of the time scale it has recently been suggested that more northern tribes of the Athapascan linguistic stock (inhabiting the kenzie River area and so nearest to Asia) have reached the New World the beginning of our era.

All this goes well with the relatively primitive condition of the cult generally accepted as having been that of the immigrants. Even at time of the Discovery, although there was cereal culture there was plough, corn was ground with the push quern, but the rotary quern unknown, while the wheel did not exist in any form, so that pottery built up by hand or with the aid of a mould, and transport was by hum porterage, travois, or sledge; there was no metal working except Mexico (where copper and even bronze were used to a limited exte the only exceptions being in the fortunate areas where native cop existed, and even here no more was done than laboriously to break a pieces of metal which were afterwards hammered into shape without aid of heat.

The physical anthropology of the American peoples has not yet b systematised, and no classification can at present be grounded there even with a linguistic basis. Therefore, as a geographical or cult grouping has much practical convenience, it is customary to adop division into areas of material culture, each possessing distinc features. The location of food areas laid down the general lines of th cultural groupings, the characteristic of such an area being the tende to specialise in some one or two foods, and the New World is thus c prehended under eight large food areas (*see Fig.* 8). Thus, in N America the Arctic and Sub-Arctic region is the natural home of caribou or American reindeer; on the Pacific slope we have the salr area; to the south, in California, the area of wild nuts and seeds, the acorn as the most typical food; in the heart of the continent, the b area; the eastern maize area in the Eastern United States; from Colorado River through Mexico to the lower part of Chile is the are intensive agriculture, in which maize is again the leading food; manioc area comprises the interior of the southern continent (altho this latter vast region is too little known for us to be able definitel characterise the food of the whole area); finally, the lower part of continent has certain similarities to the caribou area, the chief animal being the guanaco. Of these eight food areas, three may grouped as the homes of hunting peoples, three of agriculturalists, on fishers, and one of gatherers of wild seeds.

With this geographical grouping a cultural grouping is generally c bined, that is, a classification of social groups according to their cul traits. Wissler gives fifteen areas, each conceived to be the hom a distinct type of culture spreading from a centre. Groups of tr are thus located as constituting culture centres, and other tribe

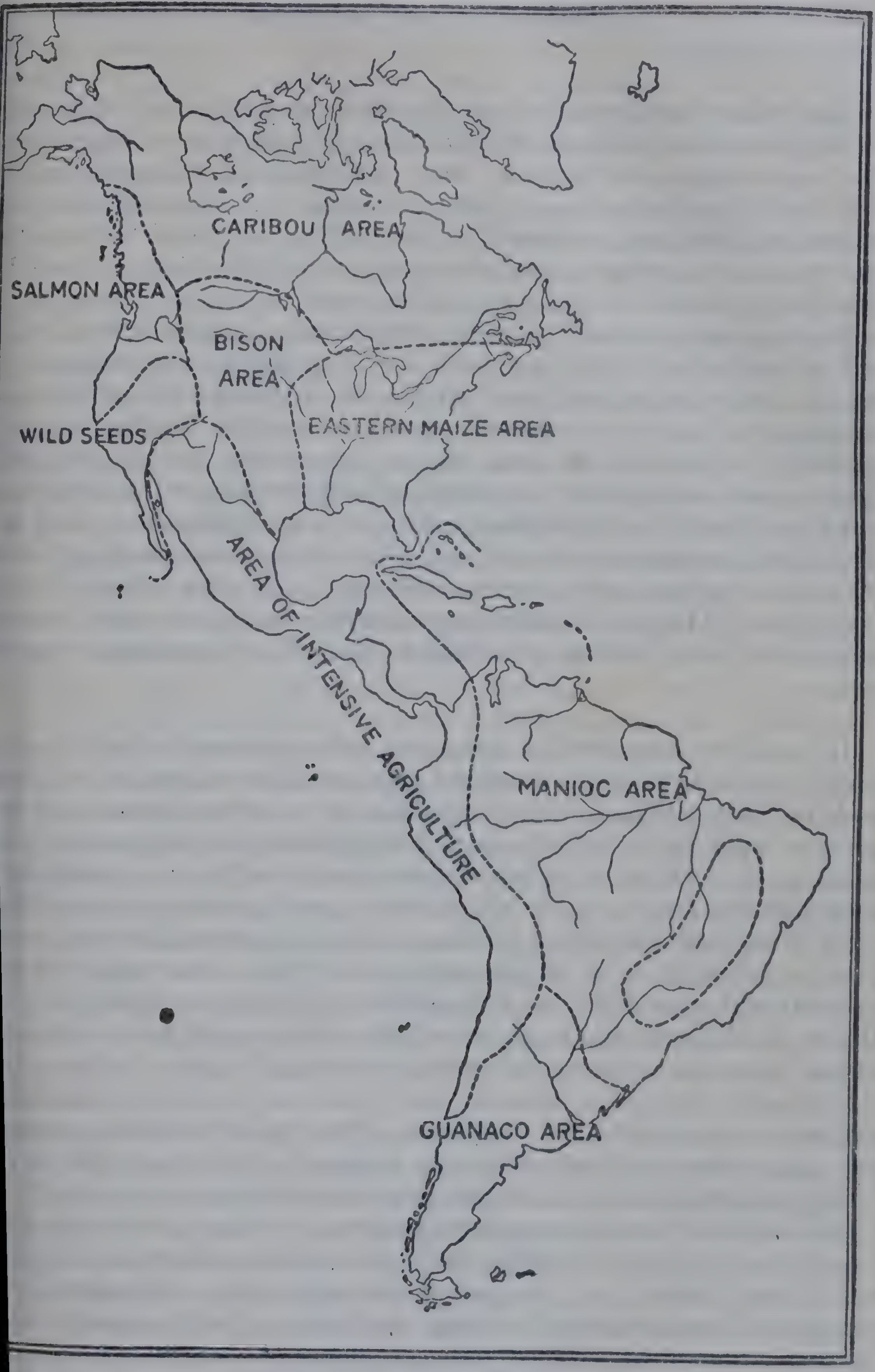

Fig. 8.—FOOD AREAS OF THE NEW WORLD

intermediate or transitional. Space will only permit brief mention c few of these areas.

The Eskimo area spreads from Greenland to Alaska, and these tri have developed a highly specialised culture to meet the requirement the unpromising environment, such archæological researches as h been made tending to show that this culture has remained essenti unchanged for many centuries. Winter sealing, combined with cari and musk-ox hunting in summer, are the principal occupations. skin tent is general in summer, and the snow house, as a more or permanent winter house, prevails east of Point Barrow. Owing to lack of vegetation in these regions the Eskimo depend almost entirel animal food : the skins of seals furnish the material for their tents clothing, the flesh is almost their only food, and the blubber the in pensable fuel during the long winter, when they live in solid s houses, each occupied by two families. Each settlement has a headn but his authority is very limited and there is no obligation to obey l The textile industry is absent except for a little basket-making ; im ments and weapons are in the main of ivory, bone, slate or stone. Pot is unknown. The long Arctic winters provide the Eskimo with leisur develop the art of carving, especially in ivory, to a high degree of per tion.

It would be consistent to give some such summary as the above each of the eight remaining cultural areas generally recognised in Ca and the United States,[1] but a suggestion of the results has already l given on page 476, where the characteristic foods that have done so m to shape the culture of each area have been cited. It may, however mentioned that in the valley of the Mississippi (the south-eastern cu area) there is archæological evidence of a much more advanced cul than is found there at the present day, for this is the region of g mounds and earthworks, once thought to be of enormous antiquity, the work of a vanished race, but which later research has shown t almost certainly constructed by the historical Indians, tribes of Algonquian, Iroquian, Siouan, and Caddoan stocks. Archæolo evidence also points to the continuity of the type of culture represe by the present-day Pueblo Indians, centred in the upper Rio Gr Valley and extending into Mexico (the south-western culture area). Pueblo culture takes its name from the towns or villages of stone or a (sun-baked clay), and exhibits traits not found elsewhere in Canad the United States, *e.g.* the art of masonry, main dependence u maize, the loom or upward weaving, the use of a grinding-stone, an domestication of the turkey. There is evidence of connection betwee Pueblo area and the Aztec of southern Mexico, though no architec evidence of any continuous chain of culture between the two exists. The Pueblo Indians were accustomed to ornament cerem objects of shell and bone with a mosaic incrustation of turq and lignite, an art practised on a far larger scale by the Aztec, an e are important turquoise deposits in New Mexico but none in thern Mexico, it is likely that the Aztec obtained their supplies, ›ably by indirect trade, from the Pueblo area. The marvellous nples in the British Museum represent the acme of this turquoise ustation, and are generally admitted to have been sent to Europe by tez or his companions.

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[1] For these areas see Keane : *Man, Past and Present* (1920) and Wissler *American Indian* (1922).

he peoples of Mexico and Central America may be regarded as con- ıting the (tenth) Nahua culture area. Here the interest centres chiefly the two great ethnic groups—Nahuatlan and Huaxtecan—whose ions were so closely interwoven that they can hardly be considered rately. At the time of the Spanish conquest there was one culture from Grande to Lake Nicaragua, typical representatives of which were the c of Mexico City—a branch of the Nahuatlan family—though the ote and others were almost equally typical. (The Zapote language is spoken by a few natives.) Centuries earlier the culture centred round Huaxtecan Maya in Honduras (later in Yucatan), who have left be- l them the most impressive ruins in the New World. The Early Maya e among the aborigines of America had developed a hieroglyphic ot—though other tribes had advanced pictographic art—and their ıre is an extraordinary example of artistic and technical development ng a people ignorant of bronze and iron. Stelæ have been found dated n about 300 B.C., at which time the population must have attained atively high degree of civilisation, including an advanced architec- , a calendar system, and astronomy, while legendary chronology s us back another three thousand years. It should be noted that the Maya worked both copper and bronze. Maya building comprised oliths, temples, and " stepped " pyramids, but magnificent as these dings were, they show that the Maya were ignorant of three important ciples—the use of mortar, the bonding of corners, and the true arch. pture was mainly in relief and was highly skilful ; perfect profiles portrayed, and even three-quarter figures in correct perspective. art of pottery was highly developed, and vessels were painted in rich gns. Maya religious beliefs were portrayed in the symbolic and cere- ial nature of their art, the rain god being the deity most frequently esented.

he reason for the desertion by the Maya of their age-long settlements ins a mystery, but it is certain that when Cortez passed through the try these wonderful sites had long been swallowed up by jungle, and paniards found the Maya no longer in cities but living in independent l groups. At the present day primitive and loosely organised groups ound in this area, speaking Maya languages but with no knowledge eir calendar system or writing. Maya intellectual culture, being ex- ve to the priestly caste, either passed to the Aztec or into oblivion. fore the collapse of the Old Empire, Maya civilisation had spread e Mexican Valley, where it was adopted by the Toltec, immigrants the north. The Toltec were followed by a series of invading tribes uatl-speaking) culminating in the arrival of the Aztec—skin-clad ıds, practising a desultory agriculture and ignorant of weaving and arts. It was not until 150 years before Cortez that the Aztec became endent, their rapid rise to dominance over the other tribes of the

valley being probably due to their introduction of the bow, together w
a genius for political organisation. Their rule was based on a pecu
system of ceremonial war—in which the taking of prisoners for sacrifi
purposes was the main object—and of trade guilds, many of wh
represented submerged tribal groups. Their culture was based on that
the Maya, from whom they borrowed much, including their calendar a
deities, and these Maya gods, for the most part of a relatively mild t
like the Maya themselves, became in the Aztec pantheon bloodthi
demons demanding countless victims. Religious festivals were celebra
in accordance with the calendar, and human sacrifice was on an alm
incredible scale; besides the annual sacrifice of a young man to
Creator god, there were the gruesome ceremonies in honour of
fertility god, involving the wearing by the participants of the skins of
victims, flayed after their hearts had been torn out on the sacrifi
stone.

In South America five great cultural areas may be recognised, tw
which, the Chibcha and the Inca, are particularly interesting on acco
of the high civilisation attained by some of their constituent peoples.
may pause here to note that, in general, the southern populations of
continent present more violent contrasts than those in the north;
wild tribes touch a profounder depth of savagery, while the civil
peoples attain a higher degree of excellence in the arts of engineer
architecture, and political organisation. As in Mexico many of the
huatlan tribes remained savages, so in Colombia the semi-civilised M
cayans were surrounded by numerous kindred tribes who were
savages, wearing no clothes and practising cannibalism; cannibal
seems to have been everywhere more rife in the south than in the no
where it survived only as a ceremonial rite.

There is generally a close connection between the surviving peopl
the Isthmus and Colombia, where we come to the most northerly of
great linguistic families of the Andes, the Chibcha-speaking peoples
agricultural folk with a highly developed irrigation system, a sun cult
stone buildings or copper, but with great skill in gold work (formerly
centre of the art for the New World). At the time of the discovery
Muysca Empire, the most powerful of the Chibcha group, was co
minous southward with that of the famous Inca of Peru—the domi
nation of the Quichuan race—though the two civilisations seem to
been quite distinct.

Like the Aztec, the Inca built their empire on the ruins of an ea
civilisation, of which the megalithic remains at Tiahuanaco (at
southern end of Lake Titicaca, now 13,000 ft. above sea level) are
most important monument. This pre-Inca civilisation appears to
flourished at about the same period as that of the earliest dated M
monuments, though as the Peruvians, unlike the Maya, had evolve
form of script, even of a pictographic nature, we have no means of da
their architectural remains. (The only form of record used by the
was the quipu, an elaborate system of knotted cords.) The ruins of
huanaco are megalithic, with a celebrated monolithic gateway;
masonry, apart from the great size of the blocks, is almost unique in
the stones are polygonal and often carved with re-entrant angles,

e being cut to fit its immediate neighbour. The pottery is also of ellent technique, and that found at Truxillo (“ proto-Chimu ”) is some he most remarkable ever produced by a people ignorant of the wheel, modelled vases in human form giving us minute details of the dress physical characters of the population. Metals, both gold and copper latter often a form of bronze), were known and worked to a far ter extent than among the Maya.

any centuries elapsed between the fall of this megalithic civilisation the rise of the Inca towards the end of the eleventh century A.D. dition agrees that the Inca, with the sun as their tribal god, entered u from the south, probably from the Bolivian highlands. At the time iscovery eleven Inca had ruled in Peru, by which time their empire tched from Quito in Ecuador to the River Maule in Chile, comprising e than 35° of latitude, and they had assumed the position of a ruling e rather than a dominant tribe. The system of control of this enormous was a rigid combination of theocracy and state socialism, based on ef in the ruling Inca as a god on earth ; agricultural labour and military ice were compulsory for all, and no member of the tributary popula- might move from his village or marry outside his district. The Inca e wonderful road builders, and though their masonry lacked the force he older civilisation their buildings, of rectangular stone cut to size accurately fitting without mortar, are perhaps technically the most ect ever constructed by a people ignorant of iron. There was com- ated ceremonial worship, and human sacrifice took place, but not arently, as among the Aztecs, on a large scale. The Quichua dialect ill spoken over this area.

he great basin of the Amazon is one of the world’s most typical ical areas, but in spite of the savagery of many of its tribes there is ost everywhere some native agriculture—manioc (the tapioca plant) g the staple crop—though the tribes are not dependent on it as are e of the intensive agricultural area, and the responsibility for cultiva- is usually assigned to the women.

he countless aborigines of the Amazon and Orinoco basins are domi- d by four linguistic stocks, the Arawak and Carib in the north- , the Tupi and Tapuya in the south-east. Of these the first pair are most widely distributed and occupy the whole of the West Indies, as as the greater part of Venezuela, Guiana, and Northern Brazil. sically the Arawak and Carib are very similar, and the ethnic division dmittedly on linguistic grounds only. The Tapuya (Botocudo, Ges, are the aborigines of Eastern Brazil, and include many primitive st tribes. Both in culture and physical characters they perhaps repre- an early type of immigrant, possibly allied to the type known as oa Santa, to which some ethnologists have attached perhaps undue ortance. All their implements are of wood, they do not work stone, they have no tradition of migration ; they are pure nomads, roaming woods in a nude state in search of roots and berries, and are notorious ibals. The Tupi formerly occupied an immense area, estimated at quarter of the southern continent, and extending into Peru. They an aggressive people, addicted to cannibalism. Most tribes practised ulture to some extent.

The Highlands of Bolivia, Patagonia, and the lower half of Chile co prise the so-called Guanaco area, the Araucanian, Puelchean, and Tso kan (Tehuelche) being among the most important stocks. Here domestication of the llama and alpaca provides the only example pastoralism in the New World ; the Spanish colonists introduced hor and cattle, and, like the Indians of the North American plains, the nati of this area quickly developed an intense horse culture. These people said facially and mentally more to resemble Europeans. To the Ar canian group belong the folk commonly called Pampaen (Pampas dians), now mainly represented by the half-breed Gauchos.

The Patagonians (Tsoneca), of giant stature for South America (st. 72 in., C.I. 85), are of uncertain origin, and it has been suggested t their original home was amongst the Bororo of Matto Grosso in Bra whom they closely resemble. The Bororo are said to be an exception tall, round-headed people (st. 68½, C.I. 81.5).

The native life of the most important islands of the Antilles was aln completely stamped out by the Spanish conquerors. So far as we kn the pre-Columbian population was first pure Arawak, but later over by Carib.

The Yahgan, the aborigines of Fuegia, are a sea-shore people, form cannibals, and with a culture so primitive that it may fairly be descri as of bone and shell.

OCEANIA

Oceania is broadly taken to indicate Australia and the island group the Pacific, but does not include the Aleutian Islands in the North Pa nor even the islands of Indonesia. Its natural geographical units are P nesia, Micronesia, Melanesia (including New Guinea), Australia, Tasmania, while the peoples that have gone to populate it are Negr (in New Guinea), Polynesians, Micronesians, Melanesians, and Papu with their archaic branch, the Tasmanians and Pre-Dravidians (Aus lians). Of these peoples the pygmy Negritos, the Tasmanians, and Australians are by far the most primitive.

We know little about the pygmies of New Guinea, except that they no longer a food-gathering, hunting folk, but practise much the s agriculture as their taller neighbours. As already stated, the typical uan is short, dark, and long-headed, though mesaticephalic and brachycephalic " islands " occur, *e.g.* in the southern part of British Guinea. We cannot account for these variations ; presumably they ar result of miscegenation. Be this as it may, it seems that a somewhat able Papuan stock at one time existed over the whole of Melanesia. (with Negrito admixture) we may account for the short stature of s Papuan hillmen, for the extreme dolichocephaly of some Fijian tr and the extinct Tasmanian with his dolicho-mesaticephaly and mec stature.[1]

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[1] The Tasmanian " may be regarded as a somewhat generalised varie the Negrito-Papuan stock, which at a very early date crossed Australi was isolated in Tasmania by the formation of Bass Strait before the tralians reached so far south " (Haddon : *The Races of Man*, 1924).

The Australians, whose physical characters are described on p. 445,
resent an old and unusually homogeneous stock, indicating, in spite of
bable foreign cultural influences, no effective immigration into the
tinent since their arrival.

Ve may feel confident that these three primitive types reached the
ific by the Malay Peninsula and Indonesian Islands. The presence of
mies in the Philippines makes this clear for the Negritos. We have
direct evidence for the Papuans, but for the Australians our knowledge
nore precise ; not only has a fossil " proto-Australian " skull been dug
at Talgai in Queensland, but two skulls in fossil or semi-fossil condi-
n, clearly Australoid in character, have been found at Wadjak in Java.

ll this seems relatively simple, probably because we are dealing with
rations of high antiquity. The migrations of Polynesians are much
re recent and more difficult to understand, while of the past history
he Micronesians and their history we know practically nothing.

The position when the Polynesians entered the Pacific was roughly as
ows. The islands that are now Polynesian were uninhabited, or some
y have carried a primitive " black " population. The Polynesians, start-
from Indonesia, moved eastwards through Melanesia to their future
nes in the Eastern Pacific, so that even now a line drawn from New
land through Fiji to Hawaii cuts the Pacific into eastern Polynesian
western Melanesian-Papuan areas. We can even indicate a portion of
route taken by the Polynesians in passing through Melanesia, basing
conclusions on small island populations showing Polynesian charac-
in the midst of Melanesians. Thus the Polynesians passed along the
th coast of Netherlands New Guinea, sailing westwards round the
marck Archipelago (leaving traces at Abgarris or Fead Island), then
th-east, north of the Solomons (colony on Ontong Java), and so to
opia, the most important of these colonies. There is, or was, a colony
Uea (Wallis Island), but this is generally taken to be a backwash from
ynesia.

o much for the pre-history. Traditionally, and probably in actual
, the Samoan group formed a rallying-ground for the migrants, who
be supposed to have left Indonesia some 2,000 years ago, and Savaii
ne of the Samoan islands, originally Savaiki—is a name which in one
n or another is found, often as the homeland, accompanying the Poly-
ans all over the Pacific.

or the sake of simplicity we have spoken of the Polynesians as though
were one people, but it is certain that there was a number of greater
es, each carrying, according to Rivers, its contribution to the culture
we call Polynesian. We can indeed differentiate physically two main
ks, varying in stature and cephalic index, which have been well des-
ed by Haddon.[1] The first stock, represented by the more European-
ing Maori, is tall and of slender build, with relatively long head and
, open eyes, narrow and high nose ; the lips are thin, hair abundant
ace and body, and the skin generally light. The second stock is slightly
hycephalic, and may be regarded as carrying " proto-Malay " blood ;
type is shorter than the first, with coarser features, the skin is darker

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[1] *Op. cit.*

and hair less profuse. We may add that a type with Melanesian characte
istics also occurs in New Zealand, indicative either of pre-Maori Me
nesian settlers or, more probably, a high proportion of Melanesian blo
in particular groups of colonising Polynesians.

We are now in a position to understand the physical characters of t
Melanesians, as apart from Papuans. We may, if we like, lay stress on t
tendency to variation in the Papuan stock (very obvious to any obser
in one hundred miles of New Guinea coast), but in any case we can b
explain the modified physical characteristics of many Melanesians—
cluding the sometimes lighter skin, the smoother, less craggy bones,
less consistently frizzly hair—by a slow soakage of Polynesian blood wh
has spread slowly from community to community during the last t
millennia or more.

Of Micronesia we know very little, but in essence the story is the sa
with presumably a far greater amount of Indonesian blood. There
much variability from group to group : in the east the skin is light,
hair wavy or straight, in the west there is a considerable number
darker-skinned people with almost frizzly hair.

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THE ACHIEVEMENTS OF ARCHÆOLOGY

By

E. A. GARDNER

SYNOPSIS

chæology has many branches, some of which overlap with other
dies such as history and anthropology. The earliest products of
man handiwork are the chipped flints of the palæolithic age;
ese show progressive development, and consequently afford valu-
le evidence as to period. The most remarkable remains of this age
the cave paintings of France and Spain. In the neolithic or polished
ne age are found the first examples of pottery, which continues
ough all subsequent ages as a useful criterion of date. Civilisation
d art reached a very high level in Egypt and Mesopotamia at least
fore 3500 B.C. The study of classical archæology has been carried
by travellers and excavators of all nations, especially in Greece
d Asia Minor. Many Greek statues have been found in Italy, but
y were mostly restored and placed in private galleries. Since the
d of the eighteenth century a more historical study has prevailed
d museums have been founded in all civilised countries. The his-
y of vase painting, from the Cretan and Mycenæan age through
classical period in Greece, has also been studied in detail, and the
jects represented have supplied information as to religion, mytho-
y and daily life. Gems, coins and inscriptions have contributed
atly to our knowledge. In central and western Europe the sites
wn as Hallstatt and La Tène have yielded characteristic examples
pottery and metal work.

ecent discoveries have carried back to a remoter age our knowledge
Egypt and Mesopotamia, and an interesting episode of Egyptian
has been found at Tell-el-Amarna. With new methods, especially
help of air survey, there are prospects of still further discoveries
he future.

THE ACHIEVEMENTS OF ARCHÆOLOGY

DEFINITION

The province of Archæology is by no means easy to define, a different authorities use the word in distinct senses. It should mean " t science of ancient things " ; but any attempt at delimitation between and other studies must depend partly on its subject, partly on its ai and objects, and partly on its methods. Perhaps the clearest way to real these is to compare it with other kindred studies, such as history, anthr pology, ethnology and the history of art, all of which overlap it to greater or less extent.

The materials of historical study are for the most part literary, c pending upon written documents, at least in the case of classical a modern time ; while archæology deals more with the visible and tangi remains of earlier ages. But this distinction holds only with cert branches of both history and archæology, especially with regard to su nations as have left behind them a literary record. In some cases, ho ever, notably in the cases of Egypt and Mesopotamia, there are extens historical documents, engraved on stone or impressed on clay, which h to be deciphered and interpreted before they could convey any useful formation. And the deciphering of inscriptions is generally regarded a branch of archæology. In cases such as these, the archæologist has supply the material out of which the historian must construct a rec of events and of the life of the people. But in the cases of Egypt a Mesopotamia, no less than in those of Greece and Rome, it is the fu tion of archæology to supplement the literary and historical evidence its own more special contribution to our knowledge of the past, whet illustrated by the remains of its activities, or expressed by means of arts and handicrafts.

Beyond all this there is a rapidly widening region of human knowle which is sometimes especially assigned to archæology, though shared some extent by anthropology. This is what is commonly known as p historic archæology—the only kind recognised by some of the narro definitions of the study. Archæology certainly has here a freer sco since its discoveries and theories cannot be controlled and checked the collateral evidence of other branches of knowledge—except, in so cases, geology. It is evident that a study which covers so wide an a must differ greatly in its aims and its methods, and cannot well be trea with any degree of generalisation. Its various branches may best be c sidered separately ; and for this purpose the scheme of division drawn under expert advice by the University of London is convenient, tho not of course exhaustive. For the purpose of academic study, archæol is in this scheme classified into eight sections :—

1. Prehistoric. 2. Western European. 3. Egyptian. 4. Assyrian.
5. Greek and Roman. 6. Early Christian and Mediæval. 7. Renaissance.
8. Oriental.

If Mesopotamian be substituted for Assyrian, and it be understood
t Oriental is intended to include China, India, and Persia, this list
y be regarded as suggesting the main lines of archæological studies.
The present Article deals mainly with what has been discovered about
ancient peoples who have influenced our civilisation.

PREHISTORIC

The ultimate limit of archæology may be said to be the first appear-
ce of man upon the earth. In its earlier stages this study may be held

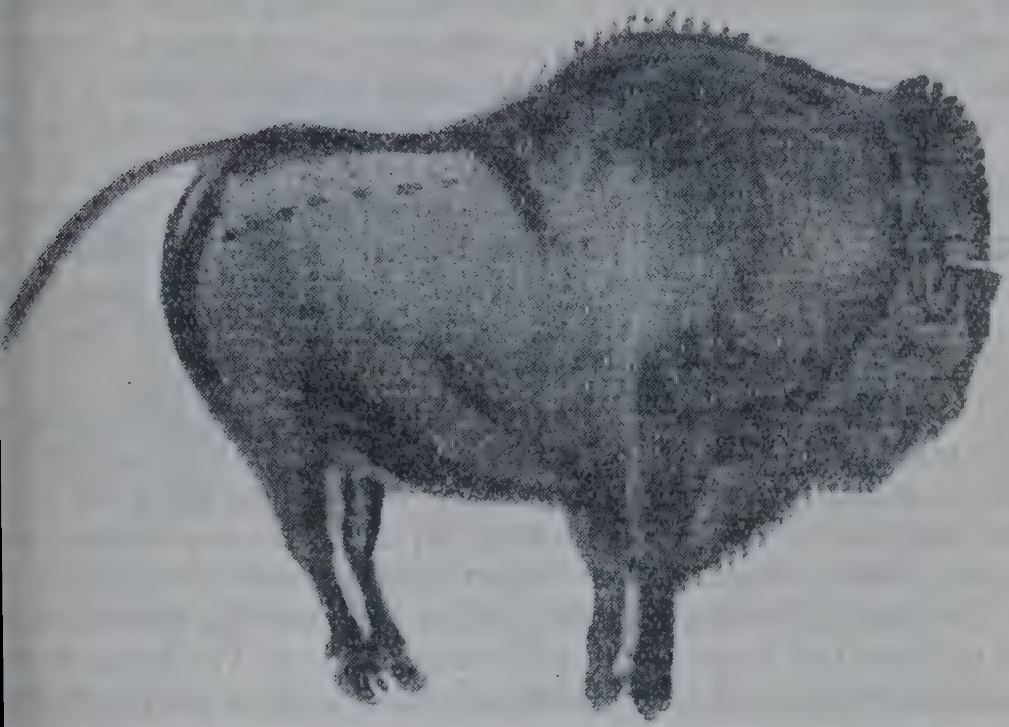

Fig. 1.—PAINTING IN ALTAMIRA CAVERN. MAGDALENIAN PERIOD

belong rather to the sphere of geology and anthropology. Prehistoric
hæology begins with the first traces of human agency or handicraft;
for a long period the series of chipped flints which have been found
ll parts of the world serve to those who have the requisite knowledge
an index and guide. They have been carefully classified, and various
es and successions have been noted of bolder and finer, until we come
he exquisitely skilful handiwork in finely shaped and chipped flints,
ich are characteristic of the later phases of the early flint or palæo-
ic age. Throughout these periods there is no historical or social back-
und to be traced except the succession of glacial eras traced by the
logist. The names given to the various styles for convenience in
ssification are mostly due to accidents of modern discovery, being taken
m villages in the south of France or Spain where the first charac-
stic specimens were noted. For the earlier palæolithic age nothing

beside worked flints has been found, but for the later periods, known by th names of Solutrian and Magdalenian, there is evidence of artistic activi of the most remarkable quality, showing a sense of form and power expression far beyond anything that appeared probable or possible at early a date (*see Fig.* 1). These discoveries, when they were first made abo fifty years ago, were received at first with scepticism ; but they have sin been amply confirmed by the discovery and publication of numerous oth similar representations in caves and rock shelters in the same region, an also of somewhat similar finds in various parts of the world, such as th drawings of the Bushmen in South Africa, though these latter may very much later in date.

The discovery of these products of the palæolithic age is the most r markable attainment of prehistoric archæology, and gives us a mo vivid notion of the life and artistic power of man at a time when nothi but chipped flints had before been known. The representations are main those of animals, including many now extinct, such as the mammot and others, such as the reindeer, long unknown in this region. There a drawings, reliefs, and modelled figures in relief or in the round. The mo primitive, probably, are mere outlines traced by the finger, or by a bo or flint, upon a more or less hard ground. The forms are correct, and t action often spirited. The natural colours are often imitated by pigmen and not only local colour but light and shade are often indicated. The early painters and sculptors succeeded in producing work of a far high artistic quality than anything known to us before the highly develop arts of Mesopotamia, Egypt, and Greece.

It has been disputed whether drawing and painting, or modelling a carving in relief and in the round, came first. The actual reproduction the shape of animals or other natural objects may appear the more prim tive, since anything like relief or drawing requires a certain abstraction convention in the translation of an object from three dimensions to tw On the other hand, drawing on a flat surface is technically the easier pr cess and requires less complicated tools or appliances. The finest work relief or in the round is done in hard materials, such as mammoth ivo or reindeer horn; this must have been worked by tools made of flint, a is often astonishingly life-like. Both in painting and in carving we fi mammoths, boars, reindeer, bisons, a primitive kind of horse, and oth animals. Human figures rarely appear, and then with no approach to t feeling for natural form found in the case of other animals (*see Fig.* 2).

NEOLITHIC POTTERY

A remarkable thing about this artistic ability of the men of the la palæolithic age is its complete disappearance in the succeeding peri without any apparent survival. This may be due to a glacial era or oth cataclysmic disturbance, or to other circumstances which we cannot tra The makers of the smoothly polished flint implements of the later a commonly called neolithic did indeed produce some representations events, with human and other figures ; but these are little more th symbolic in character, with no attempt at a realistic imitation of natu forms. On the other hand, our knowledge of the arts and handicrafts a en of the civilisation of the neolithic age has advanced rapidly in recent ears, and has received contributions from many parts of the world. noothly polished flints replace the chipped flints of earlier times, though e art of chipping flints did not become extinct, and even survives in any places to the present day. But it no longer provides the only, or en the chief criterion for estimating the relative dates of various de- osits. The art of pottery arises from the discovery that clay can be oulded into various shapes and then hardened by fire so as to hold water other materials such as grain, and so as to serve for storage, cooking d drinking. From this time on it supplies an immense variety of pot- erds, for while earthen pots are easily broken, the fragments of these main practically indestructible through all ages. Consequently, on al- ost any site that has been occupied since neolithic times, sherds of cient pottery have been found. And these, by the patient study of ex- erts and careful observation, have come to be recognised as an indication the age and attainments of the people who made them. Some charac- istics are common to many local varieties of early pottery, others vary nsiderably from place to place. For example, the earliest pottery is ually hand-moulded, and has little ornament beyond what can be made th the fingers. Other examples are highly polished, as if with a bone a flint; others again, in slightly more advanced times, have patterns cised in the wet clay with a sharp instrument. These patterns are mostly her of a wavy or geometrical style. They are followed by similar pat- ns in pigment, either dark on a light ground or light on a dark ground *e Fig*. 3). It is impossible here to give either a general or detailed de- iption of the forms of ornamentation of this early pottery. All we can tice at present is its wide distribution, not only around the Mediter- ean basin and northern Europe, but also in Asia, in Mesopotamia and rsia, and even in India, and south Russia and the Ukraine. What is more markable still is that pottery with similar decoration is found in both rth and South America. In New Mexico, for instance, it is still made the present day. It is not, of course, to be supposed that it spread from ew centres, or that similar pottery in different regions is contemporary.

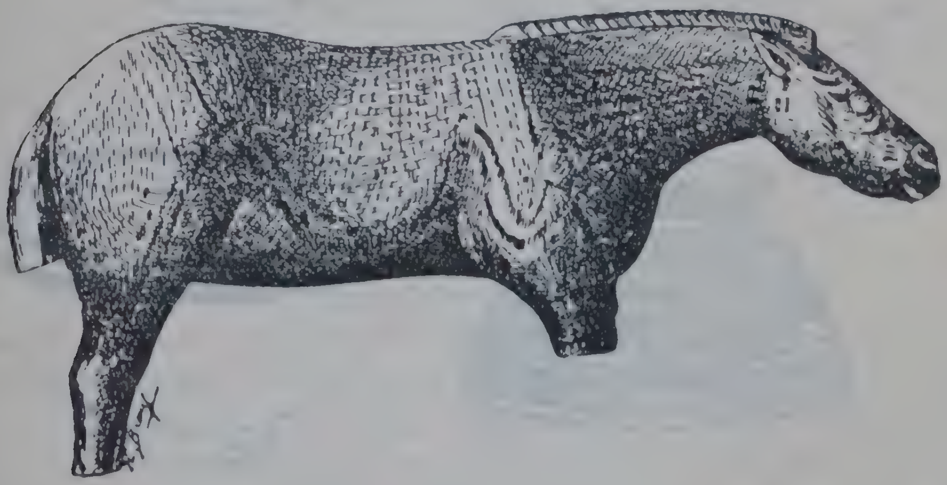

Fig. 2.—HORSE CARVED IN IVORY, FOUND IN THE GROTTE DES ESPELUGUES AT LOURDES. EARLY MAGDALENIAN PERIOD

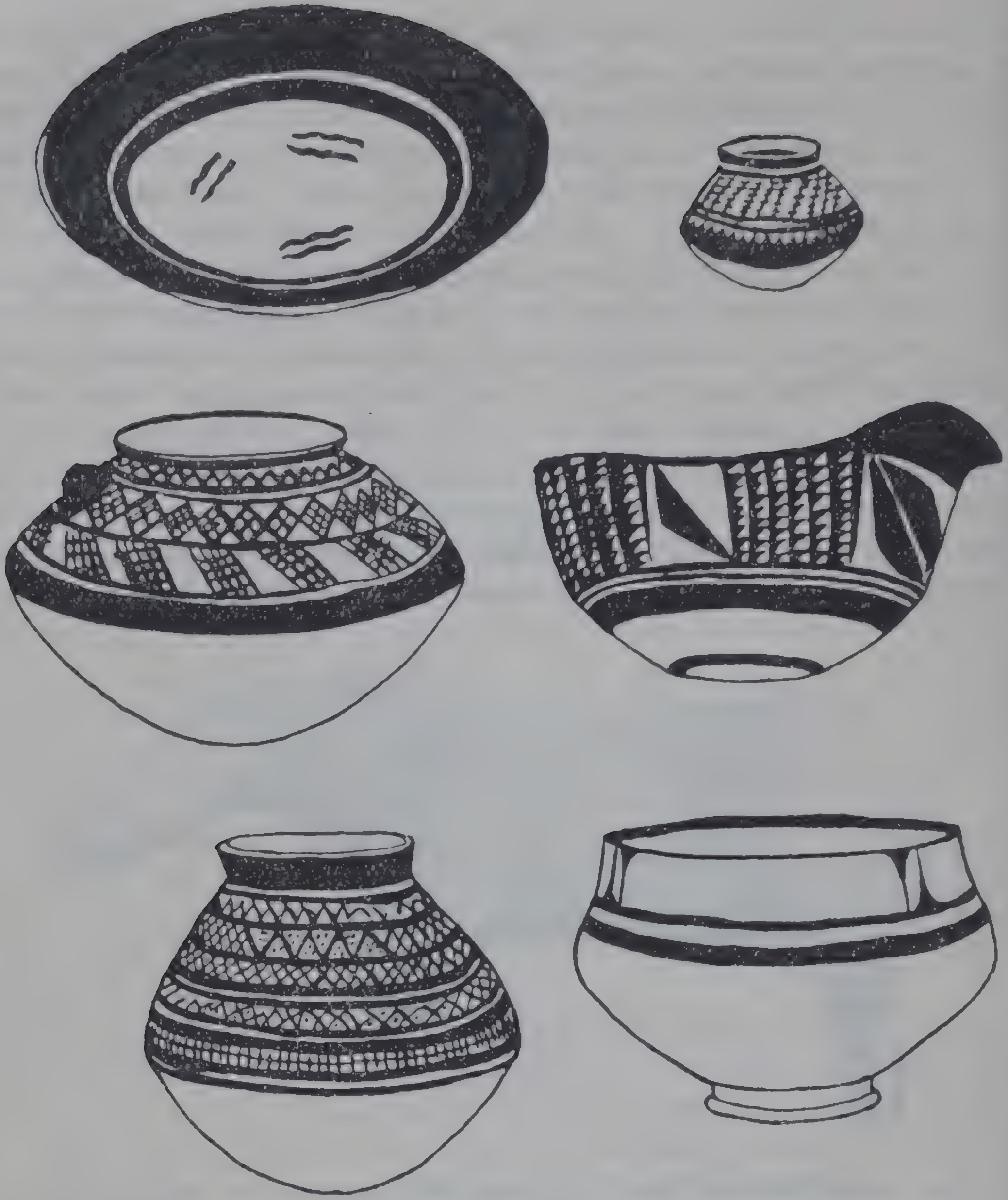

Fig. 3.—PRE-SUMERIAN PAINTED POTTERY FROM AL'UBAID
After drawings by the late F. G. Newton

It is often a difficult problem in archæology to decide how far similarit such as these are to be assigned to the direct or indirect influence of race or region upon another, how far the true explanation may be that t human eye and hand tend under similar conditions to produce indepe dently similar results. This is really more a question for psychology th for archæology.

BRONZE AGE

Unlike the work of the palæolithic age, that of the neolithic seems continue almost without a break until it is succeeded by the great advan that mark the progress of early civilisation. Remains of it are often fou in the lower strata of sites which have yielded the richest discoveries longing to later ages, such as Troy or Cnossus. The great advance mainly associated with the discovery and use of metals, copper first a probably gold, and then bronze, leading up to the great civilisation the bronze age in Mesopotamia and in Egypt. Recent years have se

markable discoveries in both regions, reaching back to the fourth mil-
nnium B.C. or even earlier. And perhaps the most astonishing thing of
is that the artistic products of these early ages show nothing of the
ntative or experimental character of a primitive art, but a masterly and
chnical skill in the treatment of metal and other materials which im-
ies a long previous training and development. Yet it remains a mystery
hence the origin of these two national arts was derived ; much may have
een developed from experimental work in perishable materials. But these
o, interacting but slightly on each other, may be traced in continuous
ccession almost to the present day, that of Mesopotamia through Baby-
nian and Assyrian to Hittite, Persian and Parthian, and many branches
Oriental art ; that of Egypt through Greece and Rome to the Renais-
nce and modern European art.

In the case of both Egypt and Mesopotamia the historian is dependent
some extent on the archæologist, since the evidence he has to deal with
mostly preserved in inscriptions. In both alike we find from very early
nes a system of writing which implies a long development from picto-
aphic script before any of the documents that have come down to us ;
d from the earliest examples to historical times these have persisted in
rious forms as a record, in the case of Mesopotamia continuing as cunei-
rm through its use to express Sumerian, Semitic, Assyrian and Persian
nguages.

CLASSICAL; HISTORY OF STUDY

The aims and attainments of classical archæology may conveniently
considered in the order in which various discoveries have been made
d various methods have been employed. Though a systematic and
ientific study of archæology has mainly been developed during the last
lf-century, earlier travellers had already done much to spread in the
est of Europe a knowledge of the remains of architecture and sculpture
at were still to be seen in Greece, and had even, in some cases, trans-
rted them to places where they were more accessible. The English
aveller Wheler, for example, described Athens as it was in 1676 ; two
ars earlier the French artist Jacques Carrey had made an invaluable
ries of sketches of the sculpture of the Parthenon, and thus preserved
r us a record of much that was destroyed in the disastrous explosion of
78. But it remained for Stuart, in 1750, to make a series of accurate
chitectural drawings of Athenian buildings, and so to enable those who
d not travelled to appreciate what Greek architecture was like in its
est examples. In 1800 Lord Elgin obtained leave to remove some of
e sculpture from Athens, and consequently the Elgin Marbles found
eir way to the British Museum. So far little had been taken that did
t show on the surface, at least in Greece. In Italy many excavations
d been made in order to find works of sculpture, but these were isolated
tues, many of them brought from Greece, which had been buried by
ance in Italian soil. With the nineteenth century began the practice of
ploring the sites of temples and other Greek buildings for the sake of
e sculptures that once ornamented them.

This was the case at Ægina and at Bassæ near Phigalia. In both cases
e excavators carried off the marbles that they found and sold them in

the one case to Munich, in the other to London. But at the same time th
architect Cockerell, who was one of the excavators, made a careful stud
and publication of the architecture of the two temples ; and he and Wi
kins, and other architects, introduced a revival of classical and especial
of Greek architecture in the buildings they designed. Towards the midd
of the century English explorers and excavators brought to England ma
fine sculptures from the Greek cities of Asia Minor—the Nereid mon
ment (*see Fig.* 4), the Harpy monument, and other tombs from Xanth
in Lycia were brought by Fellows, with the assistance of a British ma
of-war detailed for the purpose ; and similar help was given to Newto
who held the post of British Consul while excavating at Cnidus and
Halicarnassus for the Mausoleum, and to Wood during his excavati
of the temple at Ephesus.

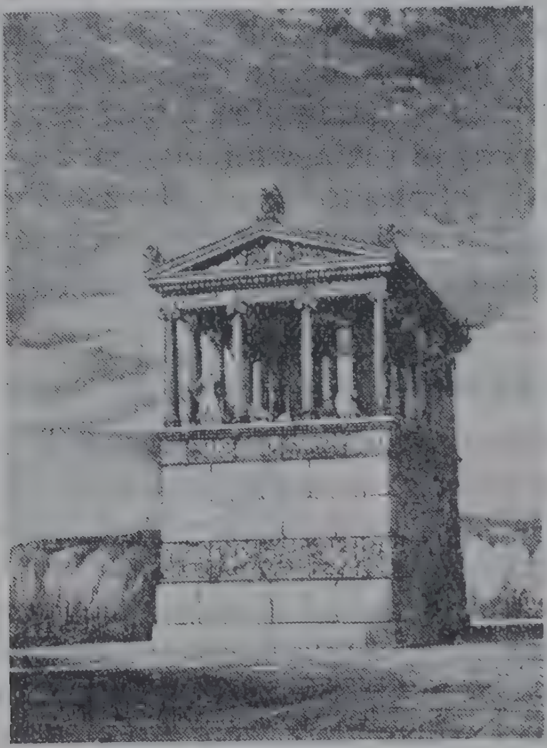

Fig. 4.—NEREID MONUMENT

STUDY IN GREECE

Meanwhile, in 1846, Penrose made those exact studies and measu
ments of the Parthenon and other buildings which revealed for the fi
time the subtlety and precision which are characteristic of Greek arc
tecture at its best. After the foundation of the Greek kingdom in 1830
was no longer possible or desirable for antiquities found in Greece to
out of the country ; but they were collected and cared for by the Gre
and by foreign archæologists, and Athens came to be the chief centre
the study of Hellenic art. Foreign archæological schools were found
there, the French in 1844, the German, American, British, and others
various intervals. All alike devoted themselves to exploration and exca
tion in Greek lands, and to the study of the buildings, sculptures and ot
works of art, inscriptions, and other antiquities preserved in the museu
at Athens and elsewhere. The Archæological Institute, which was i

nse the parent of them all, had been founded in Rome in 1829 as an ternational undertaking, but as the German element in it became preominant, other nations founded schools of their own in Rome as well as

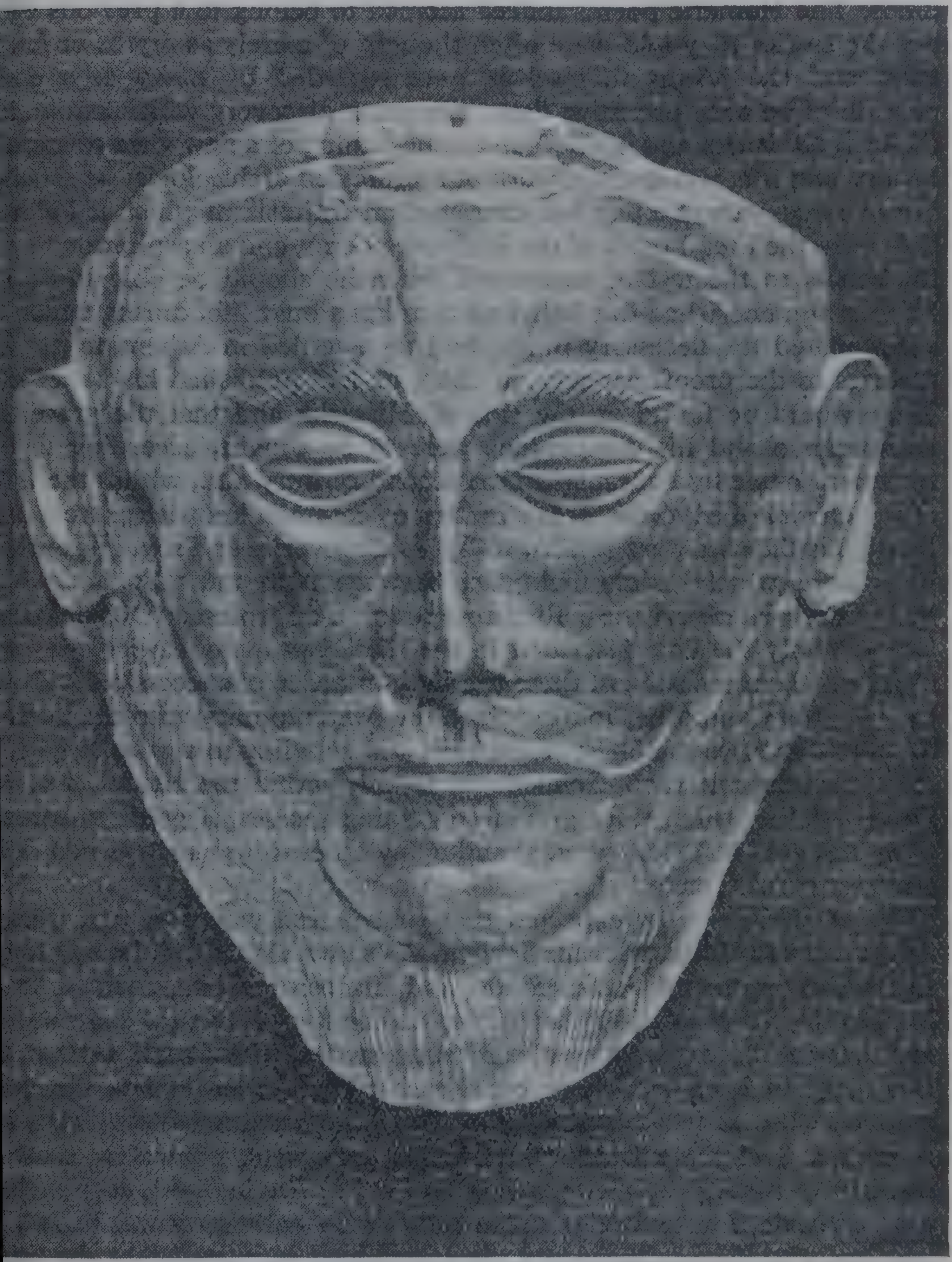

Fig. 5.—GOLD MASK FROM MYCENÆ

hens. None could take anything out of the country ; but they vied with e another in friendly rivalry, contributing each his own share to the scovery and study of the history, art, and archæology of Greece.

The limits of our knowledge of ancient Greece did not, before th middle of the nineteenth century, reach much beyond strictly histori times. The Homeric poems indeed seemed to belong to a previous age but the stories they told were often thought of merely as myths or fairy tales, and the poems themselves were regarded by many as a compilation of no very primitive date. The great discovery which astounde the learned world, and opened up the beginning of a new vista of ancie history and life, was not the work of a professed archæologist or schola but of a man who as a boy had cherished an enthusiasm which led him believe in the literal truth of the Homeric poems, and an aspiration to p his beliefs to the test of excavation when he should be able to do s Schliemann cherished this belief all through a busy life, during which h accumulated the necessary funds, and then settled in Athens to put h theories to the proof. Already, in 1869, he had published his belief th Troy would be found on the side of Hissarlik and that the graves Agamemnon and his companions were to be sought, according to th statement made by Pausanias in the second century A.D., within the wal of the citadel of Mycenæ. It is a matter of common knowledge how br liantly his theories were confirmed by his discoveries at Troy. His excav tions there, which mainly took place between 1870 and 1880, and whi had in their later part the skilled co-operation of Professor Dörpfeld, la bare not only the city described in the Iliad, but many earlier and lat cities on the same site ; of these the sixth in order of succession is show by its pottery and other indications to be contemporary with the lords Mycenæ, and has the finest stone walls still standing to a great height.

At Mycenæ, in 1876, Schliemann found, within the citadel, a sacr circle, within which were graves containing masses of gold ornamen weapons, gold masks (*see Fig.* 5) and many other things such as had nev been found in Greece before.

It was almost to be expected that such a find would at first cause certain amount of scepticism. Schliemann's own claim, that he had fou the actual bodies of Agamemnon and his companions, seemed to justified by his prediction that they would be found. But the most absu and impossible explanations were suggested at first, such as that t treasure had been left there by a barbarian invader in late Greek mediæval times. It was not long, however, before other discoveries, l numerous and magnificent, but similar in artistic character, came confirm, or modify, Schliemann's theories. The origin of this art remain long a puzzle, for no foreign art in the least resembling it was known, was likely to have influenced it. It was indeed suggested that the orig might be sought in Crete ; but until Crete could be satisfactorily explore this remained a mere conjecture. And so long as Crete remained subj to the Turks, it was impracticable to obtain suitable conditions for ex vating. In the meanwhile Sir Arthur Evans had already secured a h upon the site of the palace at Cnossus ; and as soon as systematic exca tions could be carried out, Crete at once took its place as one of the ch early centres of Mediterranean civilisation and art. It soon became vious that a people of very advanced civilisation and a high degree tistic skill had been living in Crete many centuries before it sent out to ie mainland of Greece those offshoots which had established themlves at Mycenæ and elsewhere, and which produced the remarkable ork of which the graves found by Schliemann are representative. The nnection with Crete also involved connection with Egypt at various eriods, and so provided a system of chronology which affords a firm sis for Greece also. Throughout, not only gold and silver work but also rved gems and pottery can be systematically arranged and dated, thus oviding a most useful criterion for date and influence.

EXCAVATIONS IN GREECE: OLYMPIA AND DELOS

The half-century which saw the discovery of Mycenæan and Cretan t was also marked by great and systematic excavation upon various storic sites in Greece. First among these comes the excavation of Olyma by the Germans. The site had long been known, and the French had rried off some fragments of the sculpture of the temple in 1829. The oject of a complete excavation of Olympia had for some time been erished by the Germans, and in 1876 a skilled staff of excavators was pointed. Though hardly any buildings remained standing on the site, it as hoped that the excavation would make it possible to realise, at least imagination, what the home of one of the great national festivals of reece was like in the time of its glory. This expectation was fully justid. The Altis, or sacred enclosure, could be traced, with its surrounding alls ; in the middle of it was the great temple of Zeus, its massive lumns lying as they had been thrown down by an earthquake, the ulptures that once had ornamented it scattered about or built into er walls. Two other temples, the Heræum, the earliest of Greek Doric ildings, and a later temple to the mother of the gods, were placed just low the Hill of Cronos, which dominates the Altis to the north ; and any other buildings were found, as described in Pausanias' guideok ; among the most interesting are the treasuries of the various Greek ies, some of them with rich terra-cotta ornamentation and groups of rly sculpture. It is now possible to wander round the Altis and its surundings, the porticoes to receive visitors, the gymnasium where the hletes were trained, the stadium where the foot races took place, even e grooves in which runners had to place their feet at the start. All the ulpture and other perishable material has been housed in a museum on e spot. These include the magnificent pediments and metopes from the mple of Zeus, and among individual statues found were the Hermes of axiteles, discovered in the very place in the Heræum where Pausanias v it at his visit, and the graceful Victory of Pæonius, set upon her lofty destal.

About the same time as the Germans began the excavation at Olyma, the French School at Athens undertook the exploration of another rly centre of Greek religion in the island of Delos, the birthplace and cred island of Apollo. The conditions here were very different. In ntrast to the alluvial plain of the Altis, the rocky island of Delos had le soil beside the stony débris from numerous buildings, and was, as it now, quite deserted. The funds available were much more limited, and

therefore the excavators at first had to content themselves with a caref
seeking out and recording of all ancient walls and buildings, without ar
attempt at a complete clearance of the site. This has, however, bee
carried out by degrees as opportunity offered, with the result that it is no
possible to trace the foundations not only of temples, treasuries and po
ticoes, but also of many public buildings and private houses of lat
Greek date, as well as precincts of foreign gods and other indications
the various activities of Delos in Roman times. There are also ve

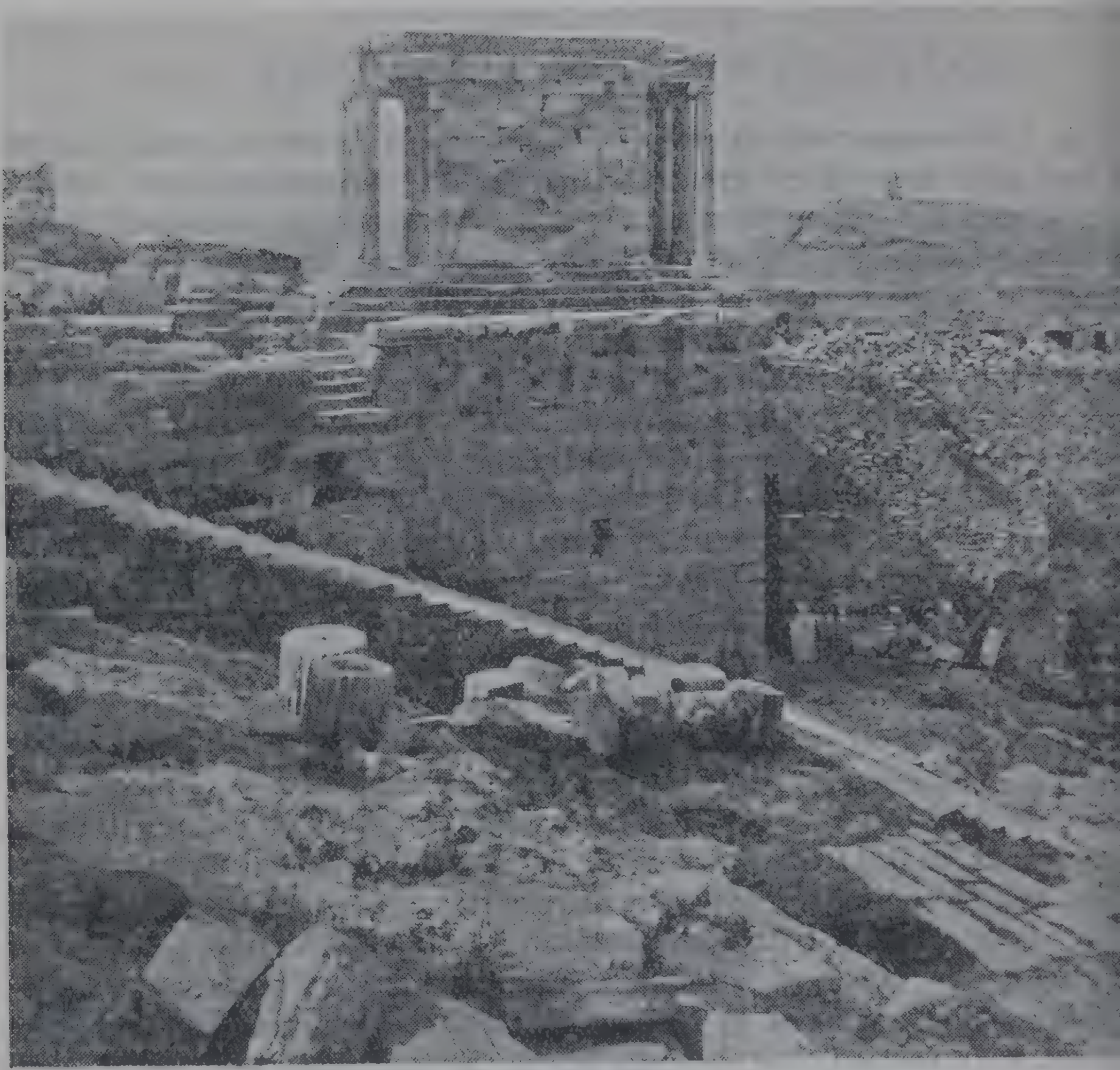

Fig. 6.—TEMPLE OF NIKE (VICTORY), ATHENS

numerous and very long inscriptions, which give much information as
the history and administration of the island at various periods, and as
the contents and property of the temple. The sculptures found in De
are of high interest. But though there is a small museum in Delos to hou
the pottery and other antiquities that have been found there, the sculpt
has mostly been transferred to the National Museum at Athens.

ATHENIAN ACROPOLIS

Meanwhile the Acropolis at Athens, the most interesting and the m
promising site in Greece, had remained practically in the same state si
the foundation of the Greek kingdom. One of the first things that w

e under the new administration was to clear away all the walls and
ses of Turkish construction ; but for the most part the bare rock was
le, so that excavation did not at once suggest itself. The Parthenon,
Erechtheum, and the Propylæa remained standing, but few other
cations remained. One of the first undertakings of Ross, the German
æologist who was in charge of antiquities under King Otho, was the
rection of the little temple of Victory (*see Fig.* 6) just outside the
ylæa, out of the original blocks, columns and reliefs that had been
into a Turkish bastion shortly before the bombardment of the
polis which led to the explosion in the Parthenon. The Frankish
r, which had been built on to the Propylæa when that building was

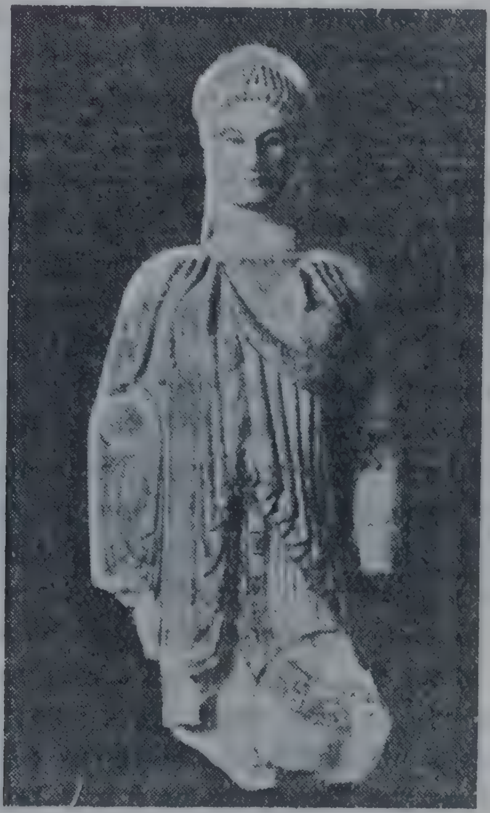

Fig. 7.—FEMALE STATUE, ATHENS

as the palace of the Dukes of Athens, and which formed a con-
ous landmark in mediæval views of Athens, was demolished in 1864,
leaving clear the plan of the south-west wing of the Propylæa.

e great scheme for a complete excavation of the Acropolis down to
ving rock was carried out in 1886 and the following years in the most
lete manner. After some trial-pits had been sunk to ascertain the
and nature of the soil, the whole was dug out systematically, begin-
from the Propylæa, and working along to the north of the Erech-
n, round the eastern end to the great accumulation of soil between
asis on which the Parthenon stands and the south wall of the Acro-
in the central area, between the Parthenon and the Erechtheum,
were found the foundations of the early temple of Athena and the
yle built around it by Pisistratus. The chief finds of early Attic
ure had been buried in the space between the Erechtheum and the
wall of the Acropolis (*see Fig.* 7). They had evidently been thrown

down by the Persian invaders, and carefully placed by the Athenians i position where they were found in the course of terracing up the gro within the new walls. As a result they give us a remarkable series w illustrates the sculpture known or made in Athens in the period before 480 B.C. A more complicated problem is offered by the strat mass of débris found to the south of the Parthenon. For the great on which the Parthenon stands was constructed to carry an earlier ten and the lower parts of the terraced earth which adjoins it must have placed in position some time before the Persian Wars. It was in this re that most of the fragments of sculptural groups and architectural ren of Piraic limestone have been found. They are evidently of earlier than the marble statues that have been found elsewhere on the Acrop

As a result of these excavations the history of the Acropolis, which f erly was hardly known before the fifth century B.C., can now be trac remote antiquity. In many places it is possible still to see the walls bu large blocks of Acropolis rock, which remind us of those of Mycena Tiryns, and must belong to the same age ; they follow the natural tours of the rock, and are in great part hidden beneath the walls o fifth century ; and numerous fragments of pottery of Mycenæan have been found in the lower strata of the terraced soil. Open pits been left in convenient places, so that it is still possible to see pa these earlier walls. Amidst the foundations of the early temple of A it is still possible to trace the remains of the well-built house of E theus which it replaced. And to this early time also belong the po and staircase that are now visible, but were hidden in classical t Another approach is through a natural cleft in the rock, which m identified as the means by which the Persians made their way int Acropolis to take the defenders in the rear, and by which also, in all ability, the maidens called the Arrhephori conveyed to the lower certain sacred objects which they were forbidden to see. Moreove sculptures and buildings of which the remains have been found e us to picture to ourselves the Acropolis as it was before the Persian and to contrast its quaint brilliance with the sober dignity of the Per age. Thus the Acropolis and its excavation offer us a striking exam how much can be gained by systematic excavation on a site that do at first seem to offer many opportunities for further discoveries.

ELEUSIS

Two other sites excavated by the Greeks offer the most interesting mation as to the rites and religious beliefs with which they were esp associated; these are Eleusis and Epidaurus. The Eleusinian mysteri always been a puzzle to scholars ; for though there is plenty of evi from literature as to the external accompaniments of the mysteries actually took place at their celebration remained very obscure. It be hoped that excavation upon the site would throw light upon this n But tentative excavations on a small scale caused more confusion they removed ; for various subterranean passages were found wh was suggested, might have something to do with sacred apparitio scenic effects. But a complete excavation of the sacred precinct has such passages, if they existed, served no other purpose than that of age. On the other hand, the discovery of the whole plan of the sacred e in which the mysteries were performed has proved most illuminat- The great hall was reconstructed several times, once probably in ime of Pisistratus, once in the Periclean age, and more than once in an times ; but in every case the same essential form was preserved— are hall surrounded on all sides by tiers of seats, cut in the rock at ack, and built up at the sides (*see Fig*. 8). This hall was entered by oors, through one of which a procession coming along the sacred way Athens would enter ; and its roof was supported by rows of columns ht angles to one another, and spread evenly over the whole space. evident that the initiated who attended the ceremonies were placed the tiers of seats all round the hall, and that the space within was ted to the hierophant and torch-bearer and other priests and officials.

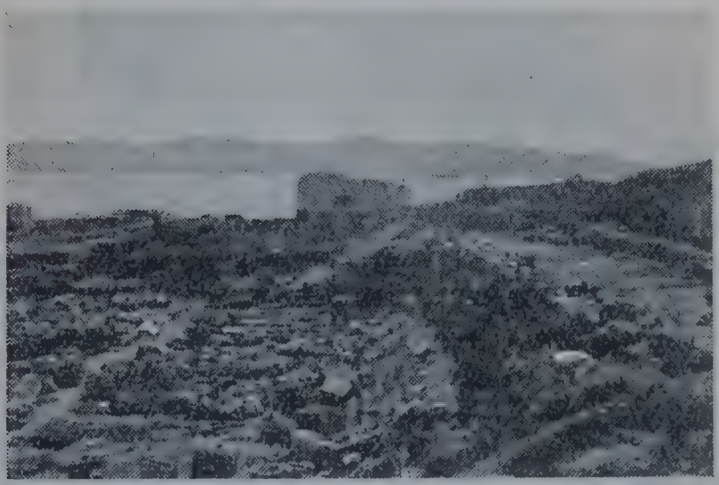

Fig. 8.—HALL AT ELEUSIS

bvious that in such a building no continuous or concentrated atten- of the spectators could be fixed upon one point, for the columns l obscure the view of a large number of them at any time. It seems low that what is sometimes called the sacred drama was rather of ture of a pageant, which, winding as it would among the lines of ns, would be most impressive. There was also a large rock-cut ter- t the back, which may perhaps have been assigned to those who had et been admitted to the full privilege of initiation, but were only in ate of novitiate. Of course these conditions do not offer us any in- tion as to what actually took place in the hall. But the more thought- ancient writers, both Greek and Roman, speak with the utmost t of the mysteries and their permanent effect upon the character of itiated in this life as well as their prospects in the next. They were red, by processions, sacrifices, wandering in the dark, and fasting, e sights and sounds that were put before them, and were doubtless ndly influenced.

EPIDAURUS

Epidaurus, we learn much of another phase of Greek religion, and e miraculous cures attributed to Asclepius. This site has been thoroughly cleared, and it is now possible to see the whole plan o sacred precinct, its temples and altar, the theatre (*see Fig.* 9) and sta provided for those who visited the shrine.

A characteristic feature is a portico in two stories, which we know inscriptions to be called the Abaton, in which the patients who ca consult the god passed the night. There is also a beautifully finished circular building called the Thymele (place of sacrifice) or Tholo outer columns were of the simple and dignified Doric order and inside were of the richly decorated Corinthian style. It was design the younger Polyclitus, who was also architect of the theatre, accord Pausanias the most beautiful in Greece. A most interesting series of ments, inscribed on marble slabs, gives a record of the cures attribu the god. It was evidently compiled by the priests from the votive t set up to commemorate the various cures. The usual formula states a patient came to Epidaurus to consult the god, slept in the Abaton

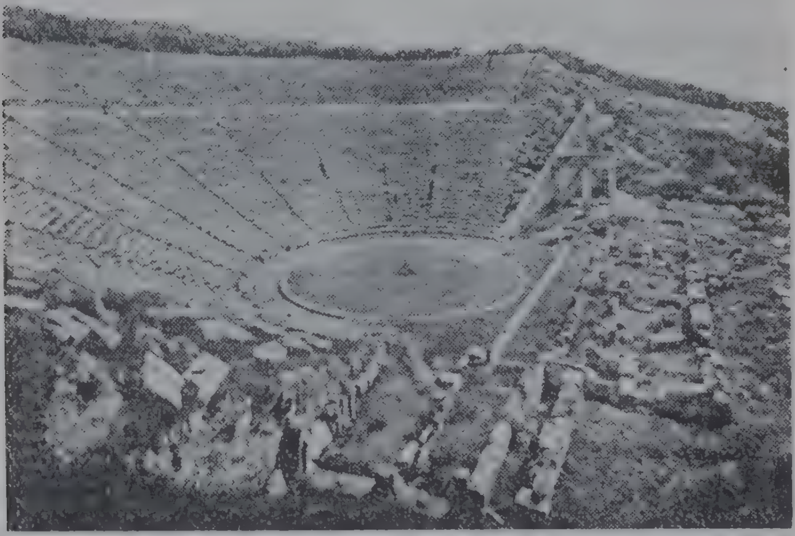

Fig. 9.—THEATRE AT EPIDAURUS

went out whole the next morning. These documents have been muc cussed from the medical point of view. Some are clearly apocrypha others record cases which may well be explained as genuine examp faith-healing, and possibly in some instances of surgical operation. interesting to compare both the custom and the cures with what still place at the festival of the Annunciation at Tenos, where people together from all parts of the Ægæan, where sick or injured peop brought to sleep in the crypt of the church, and where some mirac cures are still believed to be effected. At Epidaurus other means se have been used in later times, when regular medical prescription regimen were adopted; and the Emperor Antoninus Pius built a ho in which cases were received for medical treatment; but there evidence that the priests at Epidaurus had a hereditary practic those of Cos. At Epidaurus some sculptures were found, among the statues placed in and above the gables of the temple, which we know inscriptions to have been provided by Timotheus, who was one tors employed on the Mausoleum ; and there was a copy of the gold vory statue of Asclepius, made by Thrasymedes of Paros. It is in-tive to compare the remains of the Hieron of Epidaurus with those e Asclepieum at Athens, situated close to the theatre of Dionysus on outh slope of the Acropolis. Here, on a terrace probably chosen for eltered and sunny position, a precinct was arranged beside a primi-healing spring. This was probably done during the Peloponnesian in 420 B.C. in imitation of the Asclepieum at Epidaurus. It contains of the features which have been mentioned—a temple, an altar, a pit crifice, and porticoes in which the patients could sleep ; and these f particular interest, because it was to this very shrine that the blind

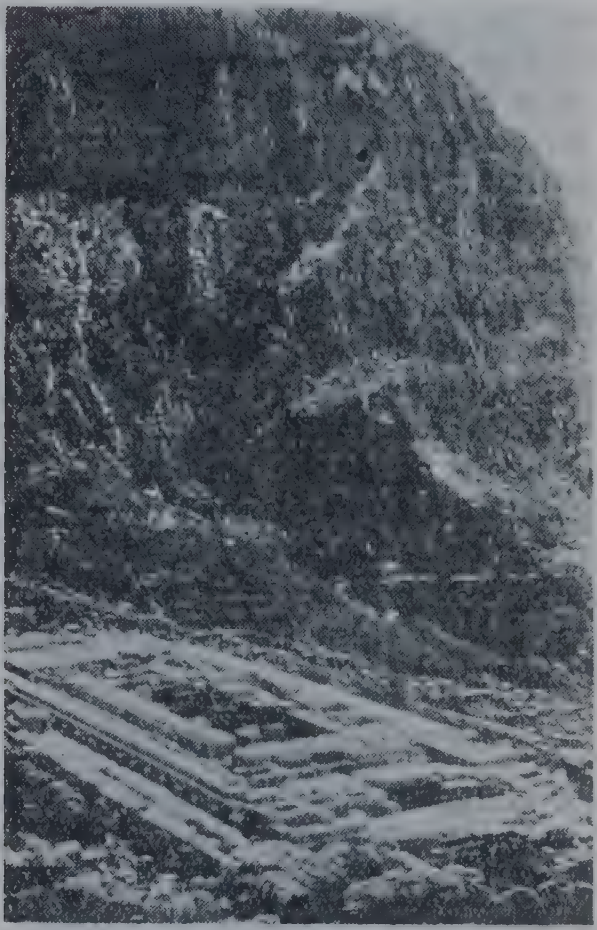

Fig. 10.—VIEW OF DELPHI

lutus was taken by his attendants in Aristophanes' play of that name. he description of what happened recalls what we are told by the ptions about the cures at Epidaurus, the god himself or his priest g about among the patients, accompanied by the sacred snakes and which also contributed to the effecting of the cures.

DELPHI

phi had for many years been regarded as the most promising site eece not yet excavated ; the chief difficulty in this case lay in the at the modern village of Castri was built all over the site of the e and its precinct. Various tentative explorations were made at in-, but with little result, except to show that extensive remains existed

beneath the modern houses. The project of complete excavation w
last taken up in 1892, and the first operation was the building of a
village on a position nearer the sea, and the expropriation of the villa
leaving the site of Delphi free for systematic exploration. The sa
precinct, bounded on each side by walls, is built in terraces high u
the rocky slope of Parnassus. The sacred way, which enters it at the l
eastern corner, takes a zigzag course from terrace to terrace, and b
it, in its lower stretches, are the treasuries of the various cities,
Olympia and Delos. Some of these—those of Sicyon, Siphnos,
Athens, were decorated with sculptured metopes and friezes. Belov
temple there was found a colossal sphinx, dedicated by the Naxians
set up on a high column, and two statues by an early Argive artist, re
senting Cleobis and Biton, whose story is told by Herodotus. O
temple itself only the foundations remain (*see Fig.* 10) ; close above i
found the fine statue in bronze of a charioteer (*see Fig.* 11), dedicat
a memorial of his victories by a prince of Syracuse. A group of at
statues includes a portrait of the Pancratiast Agias, a contemporary m
replica of a bronze original by Lysippus. In the upper part of the prec
in the east corner, was once the Lesche, or club, of the Cnidians, wi
famous paintings by Polygnotus ; only the foundations of this have
found. The theatre in the western corner is so well preserved that i
recently used for the performance of Greek plays. High above it i
Delphic stadium, with its seats in many places well preserved. It is
possible to trace the actual pavement of the sacred way, to identif
position of the various buildings and statues described by Pausanias
to realise the impressiveness of the site in its wonderful position
numerous monuments. A large number of inscriptions have been f
and carefully edited, among them the famous Hymn to Apollo,
musical notation added.

OTHER GREEK SITES

In addition to the complete clearance of such extensive and r
sentative sites as have been mentioned, there have been in Greece r
excavations on a smaller scale which have contributed their quo
the advance of the knowledge of Greek archæology. Mention ma
made of some of the more important of them. The French have d
Mantinea, where they found a plan of a circular town laid out i
fourth century B.C., and, in a church, some fine Praxitelean relie
Apollo, Marsyas, and the Muses, as mentioned by Pausanias. At T
they excavated the temple of Athena Alea, built by Scopas, and f
some of the sculptures with which he decorated the temple ; these
supplied valuable evidence as to his style. The British School ha
cavated the theatre at Megalopolis, the largest in Greece, and has
covered a remarkable and unique building associated with it, the T
silion or Parliament house of the Ten Thousand, as the meeting place o
Arcadian confederation was called. It was a pillared hall, in some
resembling that at Eleusis ; but differing in that it sloped up fron
centre to all sides, and had its columns arranged in radial lines, so
as few as possible of those present had their view of the speaker obsc
The British School has also excavated on prehistoric sites among the isl

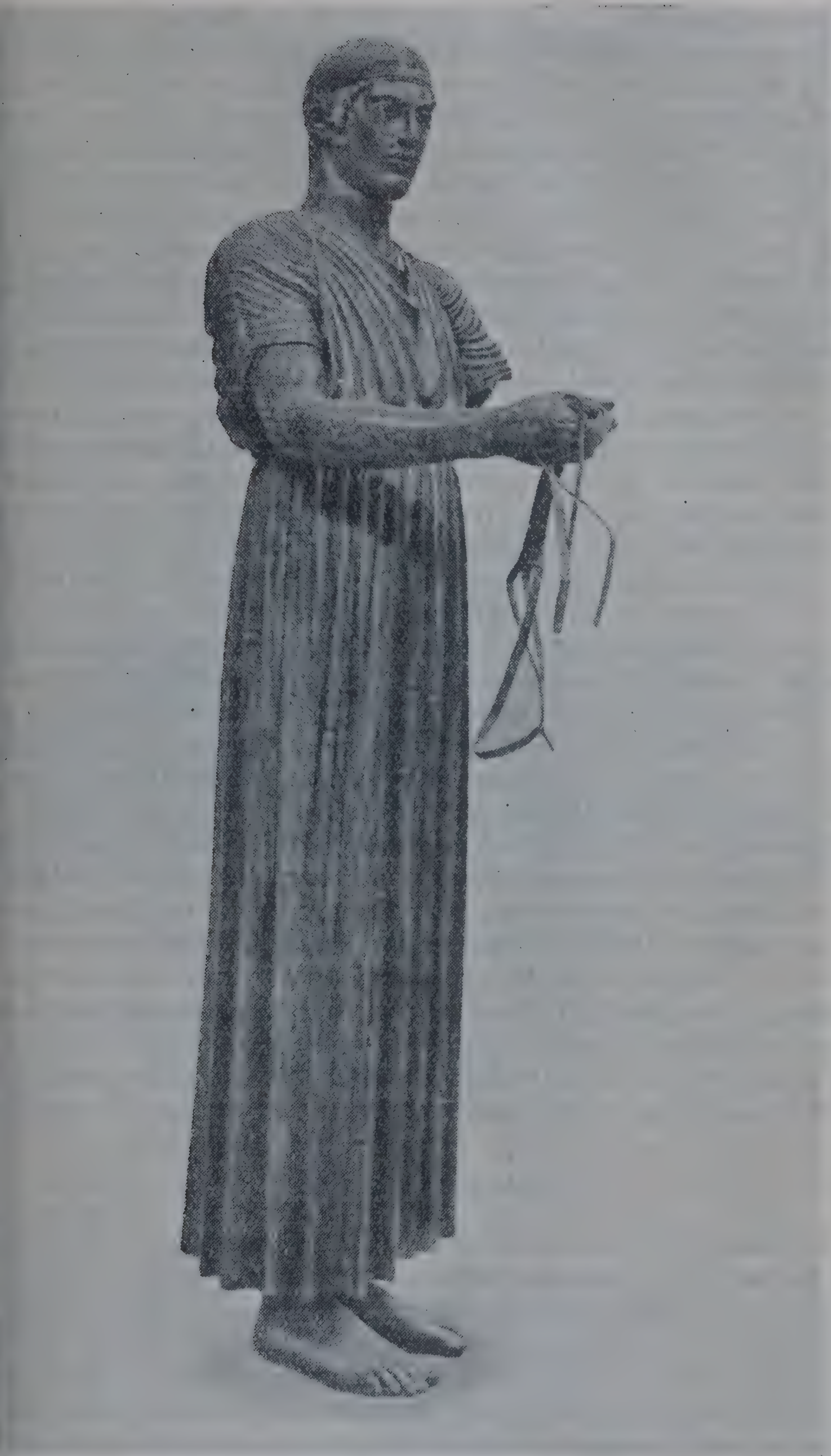

Fig. 11.—CHARIOTEER FROM DELPHI

at Phylakopi in Melos, a port for the export of obsidian, where the v and houses of an early town and a great mass of pottery were found, at the early settlement of Palækastro, at the eastern end of Crete. Bu chief activity of the British School in recent years has been devote Sparta, above all at the site of the temple of Artemis Orthia. It was a altar of this shrine that the Spartan youths were scourged until their b ran down upon it, as a test of endurance. A Roman amphitheatre had built on the site in later times, but underneath it were found succe early temples, and in the precinct there was found a stratified accum tion of pottery, carvings, lead figurines and other small objects w were observed and recorded with the utmost care, and have consequ provided chronological data for the successive periods of early Sp art ; in particular it has been proved that the ware commonly know fore as Cyrenaic was, at least in its earlier phases, of Spartan origin.

The American School excavated the Argive Heræum and found t of various buildings and a great mass of early pottery, especially p Corinthian, and other antiquities, including some of the sculptures the temple. But the chief enterprise of the Americans has in recent been at Corinth, where great masses of earth had to be moved. It is possible to see finely laid out streets and porticoes of Roman date, also the fountain Pirene, which has had various new architectural f at different times. Close beside it is a subterranean fountain hous which the bronze lion's head from which the water poured is still in tion. Here also great quantities of early vase fragments have been f and placed in the local museum.

An example of later Greek sculpture is the colossal group of fig of Demeter and Despœna seated on a throne, and Artemis and the Anytus standing beside them, which was found by the Greek excav at Lycosura in Arcadia. Pausanias, who describes the group, says it made by Damophon of Messene. The date of this sculptor was disputed ; but the data of excavation and collateral finds show th lived in the second century B.C. The group is an attempt to get ba the grand style of the age of Phidias, but there is something artificial a its style and composition such as might be expected at this period.

SITES OUTSIDE GREECE

All these excavations in Greece have been undertaken disinterest for the increase of our knowledge and appreciation of ancient Greec to add to the artistic treasures of the world. For nothing found upon soil is allowed by the law of antiquities to go out of Greece. All tha excavator retains for himself is the right of publication, and all val antiquities are preserved in the museums of Athens or other impo sites such as Olympia and Delphi. Elsewhere, until recent years, th of antiquities was for the most part less drastic, and it was possibl the excavator to carry off all or most of what he found. Thus the colle of early Greek vases from Daphnæ and Naucratis in Egypt has placed in the British Museum, as have some discoveries from Rhode Cyprus. The great Greek cities of Asia Minor have also offered a for extensive and thorough excavation, though in recent years the Tu

of antiquities has been assimilated to that of neighbouring countries,
all the important works of art discovered have been transported to
stantinople. The Germans, however, in 1878, obtained leave to ex-
te the site of Pergamon, and to carry their discoveries to Berlin. The
graphy of the town was completely recovered. Its lofty Acropolis
ained, at the top, the palace of the kings of Pergamon, the temple of
ena, the great library, the rival of that at Alexandria, and the upper
ket-place with the great altar. On the slope of the hill was a large
tre ; further down, a gymnasium and many other buildings ; and in
opmost terrace there was later added a temple of Trajan. The archi-
ure of all these was studied and published, and has enabled a recon-
ction of the whole to be drawn, showing it to have been in all prob-
ty the most magnificent group of buildings in the ancient world. But
most brilliant discovery of all was the sculptural frieze of the great

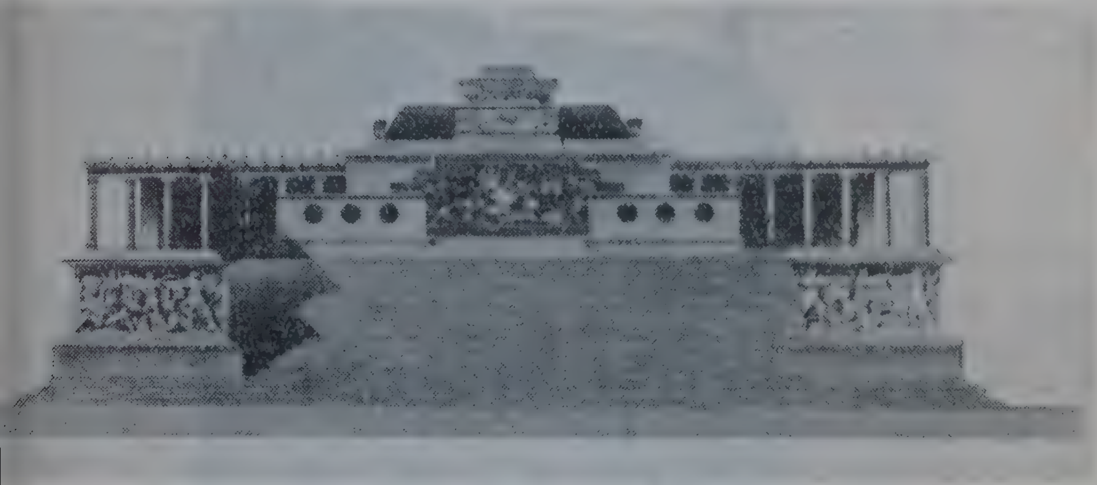

Fig. 12.—GREAT ALTAR AT PERGAMON

which had been demolished and built into later walls of fortifica-
The altar itself was about 100 feet square, and the frieze surrounded
all four sides, except for a staircase which led to the top, where the
l altar of sacrifice was placed. The subject of the frieze, which was
seven feet high, was the battle of gods and giants. Nearly two-thirds
is magnificent composition was recovered and sent to Berlin, where
onstruction of the whole has been made in a special museum (*see*
12).

cavations have been made on the sites of several of the great Greek
in Asia Minor. At Priene the whole plan of the town has been re-
ed, with its central market-place and senate-house, its temple of
na, its theatre, and its blocks of private houses which give a clear
n of the character of the dwelling-houses of the Hellenistic age.
vations have also been made at Ephesus—mainly in the Roman
et-place and library, of which a fine architectural front has been
l and restored in Berlin—at Miletus and its temple, at Branchidæ,
rdis by the Americans, and on other town sites. But the conditions
ork in this region are not favourable at present, though there are
nany sites which would well repay excavation.

One of the most remarkable discoveries made in a region then sub to Turkey was the series of marble sarcophagi found in a subterra tomb at Sidon in Phœnicia. These were carefully transported by Turkish authorities, and are now the chief ornament of the museu Constantinople. It appears that the reigning princes of Sidon had nearly two centuries, from 500 to 300 B.C., the habit of employing G artists to make their marble coffins. The earliest of these with sculp decoration is called the tomb of the Satrap, from a dignified bearded fi who appears on it more than once in scenes of banquet, battle, and h ing. The style resembles the delicate and refined Ionic work of the

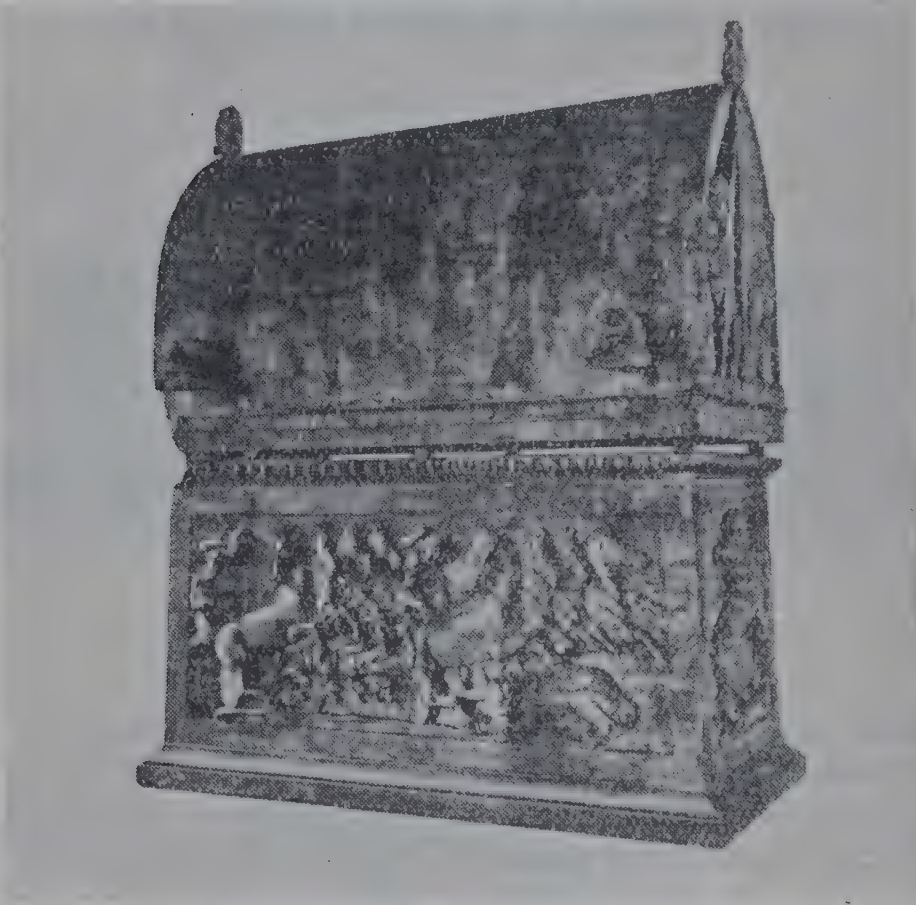

Fig. 13.—LYCIAN SARCOPHAGUS FROM SIDON

years of the fifth century B.C. The second is known as the Lycian its shape, which has the ogival roof, like a Gothic arch, commo Lycian tombs (*see Fig*. 13). This is in many ways the finest of al series; its style closely resembles that of the Parthenon sculptures, which it must be approximately contemporary; it represents hu scenes in which both Greek youths and Amazons are taking part, struggles between centaurs, or Cæneus and centaurs, on the shorter si sphinxes with outspread wings fill the curved triangles of the roof. whole is most excellently sculptured and almost perfect in preserva The third tomb is known as that of the Mourning Women, and is i form of a miniature Ionic temple; its columns do not stand free, but ject from the wall, and between them is a series of women in atti ief or melancholy. These richly draped figures, in various and har-ous attitudes, remind us of the figures which frequently appear upon tombstones, as a record of the affection of the living for the dead. s been suggested that such a tomb would be most appropriate for ıg of Sidon in the fourth century, who is said to have been strongly ıellene, and to have had Greek ladies in his harem. The largest and imposing of these sarcophagi from Sidon is that which is commonly l that of Alexander, because he appears twice in its sculptured scenes, in a hunting group where he is defending an Oriental rider from ı, and once in a battle scene. The Greeks, or rather Macedonians, he Orientals who appear on these reliefs are strongly differentiated, ırst a hardy race of soldiers, the others with delicate and sensitive res and expressions. The remarkable preservation of the colour of sculptures gives quite a new notion of their life-like effect, especially e pupil and iris of the eyes. It has been conjectured that this is the of a prince of Sidon who was set up and supported by Alexander, hat the scenes of battle and hunting refer to exploits which they had d. The work may well be of the school of Lysippus.

GREEK STATUES IN ITALY

far we have been mainly concerned with the discovery of works t upon Greek soil. In the case of these, we usually have the great ntage that we know where, and often by whom, they were originally p. But they often have survived merely by chance, and in any case represent but a minute fraction of what existed in ancient times. It ficult for us to realise the immense number of statues that once d on such sites as Olympia, Delphi, or the Acropolis at Athens. first cause of their transference or loss was the appreciation of the n conquerors, who carried off great numbers to adorn their triumphs decorate public buildings or private houses in Rome. In 187 B.C. ulvius Nobilior is said to have carried in his triumph 785 bronze 30 marble statues from Ambracia, where they had probably been ted from other sites by Pyrrhus. And Nero is said to have carried o bronze statues from Delphi, though there were apparently plenty ı the time of Pausanias. The plunder went on from time to time, of the statues being carried off to Rome or later to Constantinople. ecorded that in the sixth century A.D. there were in Rome as many 90 bronze statues; and of this total only about ten have been re-ed. These statues were some of them works of the great period and e great masters of Greek sculpture; but their identity must often been lost in the transference. In addition to these there must have a great number of copies of Greek masterpieces, or imitations, such re made for the Roman market by Greek artists of the Roman l; and these existed not only in Rome and Italy, but in all parts of oman Empire. So far the danger to Greek statues came mainly from gh esteem in which they were held throughout the civilised world. ith the inroads of barbarians and the general failure of appreciation ssical art, especially when the value of the material of which a statue ıade counted for more than its artistic quality, the fact that calls for

explanation is not how many statues disappeared, but how so many c
to survive. Gold and ivory, as in the colossal statues of Phidias and P
clitus, had little chance of escaping the plunderers; bronze was m
down for coinage and other purposes; and marble was either burn
lime, as is attested by the lime-kilns found in almost all ancient site
broken up and built into walls or other structures. In this last case
statue may be reconstructed, but usually in a mutilated state. Only a
owing to accident or particular conditions, have always remained vis
Notable examples are the Wolf of the Capitol at Rome, and the statu
Marcus Aurelius, because, it is said, it was mistaken for the Chri
Emperor Constantine; the architectural sculpture from some temples
also survived in some instances, but usually, as is the case with the Pa
non, in a much damaged state. Most, however, of the classical sculptu
now possess has at some time or other been buried in the ground.
have already noticed the instances in which it has been dug up in G
soil. But a large proportion of the statues in our museums have
found in Italy. Some had been purposely buried to preserve them in
time of stress, like the bronze boxer in the Terme Museum or the Ap
dite of Melos. Many were buried in the débris of the buildings they
adorned. Some were wrecked in vessels proceeding to Italy with the s
of Greece, like the cargo of ships discovered by divers off Cerigotto
Cape Artemisium, the athlete and the colossal Zeus (or Poseidon) w
are now among the chief treasures of the National Museum at Atl
The beautiful Apollo in the Terme Museum at Rome had fallen into
Tiber, and was found when embankment operations were in prog
The recovery of all these buried statues was at first the result of acci
But with the new appreciation of classical art which came in at the
naissance, ancient statues were eagerly sought for in places where
were likely to be found, especially where there had been palaces or
in Roman Imperial times; the richest and most famous was the Vil
Hadrian at Tivoli, where the Emperor had gathered together repres
tive works of all ages and styles. The Popes and the Roman nobles
with one another in searching for antique statues, or acquiring the
decorate their palaces and villas. They were required mainly as ornan
and not as the subjects for serious study. Broken or damaged statues
unsuitable for this purpose; and they were usually handed over t
storers, who replaced what was missing according to their own f
Some of the greatest sculptors of the time, including Michel Angelo
self, were employed upon this work. Some of them, with the help of
replicas or the evidence of other monuments, or from a sympat
understanding of the subjects, produced work which followed
closely what the original must have been. But others were less
scientious, or less gifted, and often used the mutilated remains
antique statue merely as material to work into a purely fanciful d
of their own. One instance of such a statue now in the Louvre may
trate the result. It is described in the catalogue as follows:

> "Youthful Dionysus, nude, his left arm resting on a thyrsus, o
> with his lowered right hand, a bunch of grapes to a panther seat
> his feet.
>
> "(Modern—the head of Dionysus, part of his hair, right fore-arm

w, left fore-arm and thyrsus, a part of right thigh, both legs and feet, e panther and the plinth.)"

nother case it is recorded that "only a portion of the torso is an- "; and in the case of a much restored group "the figures are only ogether by the caprice of the restorer." Such examples could easily ultiplied. Another practice common among restorers was to piece her portions of different statues, sometimes with successful effect, times with very incongruous results. The commonest example of s where statues which have lost their heads have had them replaced her heads whether antique or modern—a state of things often very ult to detect at first glance, yet very misleading to the student.

is practice of restoration was almost universal until the end of the eenth century. The last conspicuous example is offered by the nental sculptures from Ægina, which, when they had been removed unich, were restored by Thorwaldsen with so great skill that it is ult without reference to the records of discovery to tell what is nt and what is modern, the restorer and his assistant have so skil- imitated not merely the style but the actual weathering of the original les. It is evident how much such restoration falsifies the evidence and ads the student. And, since the restoration is in marble, all fractures o be cut smooth to fit on the new pieces, and consequently, when er fragments were found in the excavations of 1900, it was impossible them into the places where they belonged. When the Elgin Marbles brought to London, the Italian sculptor Canova was requested to take their restoration. But fortunately he refused, and deprecated ttempt to restore such marvellous works. He thereby not only con- l a great benefit upon posterity, but set an example which has ever affected the policy of all the authorities of the chief museums. e are some exceptions that "prove the rule," but the restored legs Hermes of Praxiteles and of the Agias of Lysippus are not satis- y, and we may remember the storm of protest, chiefly from artists, arose when it was proposed to restore the nose of the Demeter of s. There is not, indeed, the same objection to a restoration in r as if it is carried out in marble; for in this case the surface of the al may be preserved, and the addition can at any time be removed. ps the best solution in the case of masterpieces is to place a restored r cast beside the original, for the benefit of those whose imagina- oes not suffice to enable them to appreciate a statue of which por- re missing.

s change of view as to restoration is partly due to the different view study and appreciation of classical sculpture which came in about ginning, and developed more strongly towards the middle and end, nineteenth century. Before that time, those who studied or wrote classical sculpture were to a great extent occupied with finding ngs and identifications, often of a fanciful character; and these some- imposed themselves on the restorer. Examples are the giving the Cincinnatus to the Hermes binding his sandal, or Arria and Pætus Gaul who has slain his wife and is stabbing himself. Even the dying though admirably criticised by Byron, is called by him the Gladia- d so given a misleading association. The tendency even went so far

as to recognise the Emperor Hadrian and Sabina in the Cecrops an
daughter of the Parthenon pediment.

GROWTH OF MUSEUMS; HISTORICAL STUDY

The collections of sculpture which had come into existence in Italy
elsewhere were more for the enjoyment of the owner and his fr
than for the education of students; the foundation of museums as
tinct from private galleries was at once a cause and an indication
different point of view. The great galleries of the Vatican might, in
be regarded as a national rather than a private possession. The Lo
was made into a museum, mainly of sculpture, in 1793. Previous t
the nucleus of the British Museum was founded in 1753 by the w
Sir Hans Sloane, and added to by the acquisition of Sir William H
ton's collection and the Townley Marbles; and many other mus
were established in different countries. With the opportunities for s
came the intellectual impetus which has since gone on increasing.
great change in mental and critical outlook which took place tov
the end of the eighteenth century was accompanied by a keen appr
tion of Greek and Græco-Roman art. In 1766 Lessing publishe
Laokoön, which still, in spite of certain limitations and errors, rema
standard work upon the principles of art. The fact that he chos
Laocoön as the theme and title of his work is significant.[1] The strug
group of the father and his two sons, attacked by monstrous snak
compared by Lessing with Virgil's description of the same event; a
was able to recognise in this group those great characteristics of Gre
at its best which here seem to many modern critics conspicuous by
absence. Winckelmann and others spread the knowledge and appreci
of Greek sculpture; but a systematic and historical study, based ali
literary and on monumental evidence, was first attempted by Brunn
on his work all subsequent study has been founded. His book, whic
published in 1852, was called *The History of Greek Artists*. The ti
appropriate; for the whole study had to be built up upon a chronolo
framework which was based on the references in ancient writers
successors have to a great extent been employed on filling the gaps i
knowledge by fitting extant works into their proper places in the sy
Furtwängler's great work called *Masterpieces of Greek Sculpture*
published in 1893; its aim is to identify and to classify, by compa
study, a number of sculptures scattered throughout the museun
Europe and America, and to establish their relations to one anothe
the leading characteristics of the different schools and periods. It req
an extraordinary memory and critical faculty to deal with such a m
material. A distinguished German scholar said at the time, "Furtwä
has built a mountain over which we all have to climb." But from
elevation it has been possible to survey the whole field, and to find
ance in a most complicated study. There have been several other his
of sculpture. Above all the full and scientific catalogues of museums,
as the British Museum, that at Berlin, and many others, and of the
collections such as the Ny Carlsberg at Copenhagen and the Barrac

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[1] The importance of Lessing's *Laokoön* for æsthetics is also discussed i
Article on *The Principles of Literary Criticism*.

e, have contributed to the recognition and classification of sculpture; such works as the German catalogue of the Vatican, that of the toline Museum by the British School at Rome, and Michaelis' *ent Marbles in Great Britain*. The study of ancient sculpture has me excessively minute and technical, and in many cases the wood ot be seen for the trees.

CRETAN PAINTINGS AND VASES

e conditions of the study of Greek painting are very different from applying to sculpture. With the exception of Crete at the one e and Pompeii and Herculaneum at the other, very little is left to us to imagine its character. But to judge from the description of t writers it occupied a position in the ancient world as highly ed as that of sculpture. The great frescoes of Polygnotus and the dite Anadyomene of Apelles enjoyed the highest fame. But such edge as we have of these being entirely due to literary description, ardly belong to the domain of archæology, except so far as their ce may be traced on contemporary vases. The decorative frescoes in the palaces at Cnossus and elsewhere in Crete cannot be reckoned lenic art; their spirited renderings of men and animals and their listic treatment of vegetable forms find the closest analogy in the s of Akhenaton's palace at Tell-el-Amarna in Egypt (*see Fig.* 14).

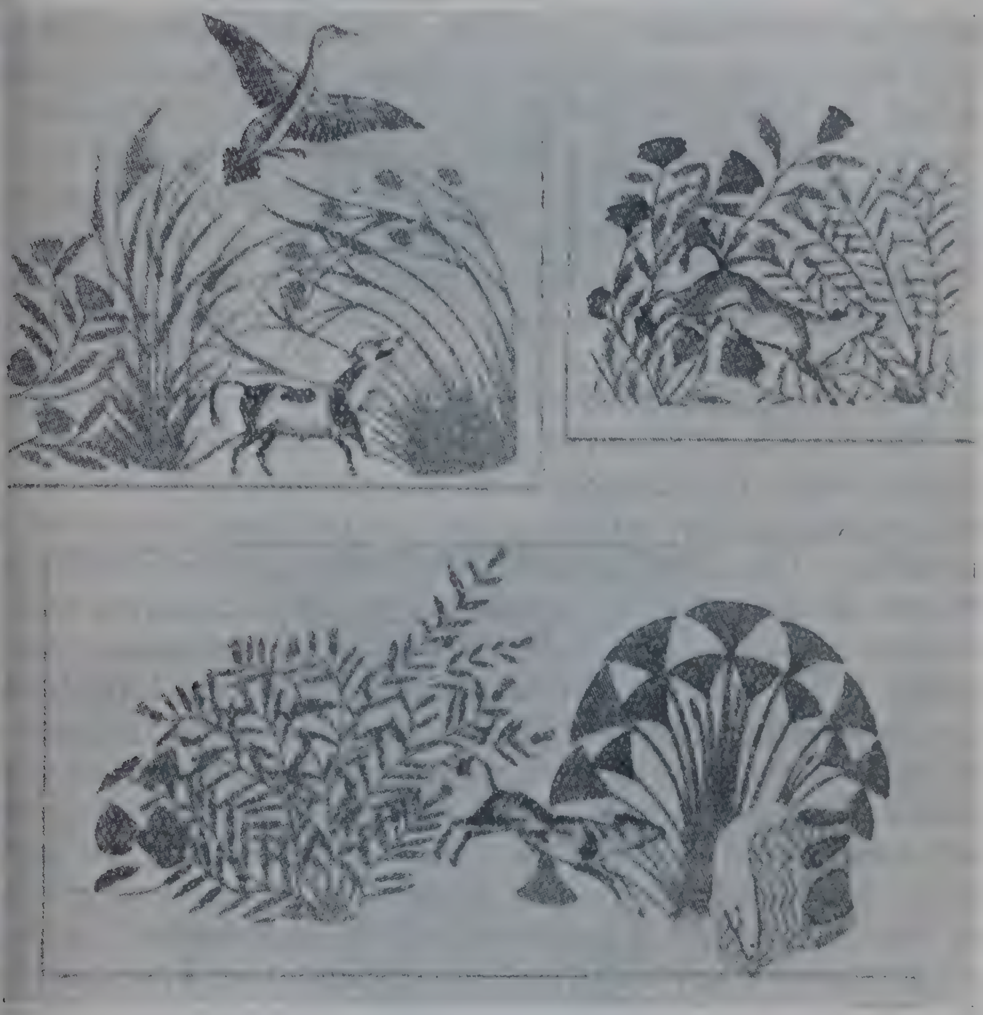


Fig. 14.—FRESCO IN AKHENATON'S PALACE

But they are not Egyptian, and their artistic style seems to have
developed in Crete itself. It was imitated in the frescoes of the palac
Mycenæ and Tiryns ; but its artistic tradition seems to have been c
pletely lost and forgotten before the rise of Hellenic art in Greece. In
art of decorating vases, however, there seems to be an almost contin
succession, interrupted by some remarkable breaks, from the ear
times to the third century B.C. In the lowest strata of the palace at Cno
there is pottery of the neolithic age such as is found in many Med
ranean districts, mostly black with geometric patterns incised and f
with white. This is succeeded by pottery of the so-called Minoan s
which is roughly divided into three periods, each of these divisible
three or more sub-sections. The Early Minoan (2500 B.C. or ear
imitated to some extent the incised patterns by painting, either ligh
dark or dark on light. The Middle Minoan (2000 B.C.), especially i
middle period, when it is called, from the place where it was first re
nised, Kamáres ware, is a fine biscuit ware of most skilful technique,
polychrome floral designs, mostly in red and white on dark ground.
type of pottery was found by Sir Flinders Petrie in Egypt in rem
dated to the XIIth dynasty, or about 2000 B.C. by the usually acce
chronology (Petrie makes it 3500). And this synchronism has since
abundantly confirmed by discoveries of dated objects both in Egypt
in Crete. The Middle Minoan third period is distinguished by more s
and restrained style, especially by monochrome designs of lilies and c
flowers in white on the natural colour of the clay, giving an al
Japanese effect. The Later Minoan age (1500 B.C.) is marked by
adoption into designs of vases of many vegetable and marine forms
lily continues but is more conventionalised, and the octopus, nau
murex shell, brittle-star, and other marine animals are introduced
decorative setting of seaweed. This develops into the rich and f
style, in which these same motives are used with more profusion an
a larger scale. This is called the Palace style, because numerous exam
of it have been found in the latest and most splendid of the palac
Cnossus. It has also been found elsewhere in Crete, and in the
graves at Mycenæ, where it was doubtless an importation. Similar
of Palace style have been found in Greece, notably at Thorikos in A
and at old Pylos in the Peloponnese. It has also been found in Egypt
vases of the same characteristic shape and ornamentation have
found represented as tribute brought by Cretans on tombs of the XVI
dynasty, about 1500 B.C. The palace of Cnossus was destroyed, pos
by invaders, about 1450 B.C., and this event was followed by the yea
highest prosperity and riches at Mycenæ and elsewhere in Greece.
style of pottery that accompanies this epoch is sometimes known as
Minoan third period. It shows most of the motives of the Palace styl
peated in a somewhat mechanical and conventional manner, and grad
loses its freshness and vigour until, in the general decadence of
Mycenæan civilisation, it gradually disappears, though not, as wi
seen, without leaving some inherited traditions to its successors. The t
Minoan eras belong properly to Crete, though stray examples of them
found elsewhere in the Ægæan area. An analogous division, however
been traced in the surrounding regions, and is known as early, middle

Cycladic for the islands, taking its name from the Cyclades. Melos, hylakopi and elsewhere, has proved very rich in characteristic ples of naturalistic flower designs, corresponding to those of the third e of Middle Minoan in Crete, and also in curiously conventionalised

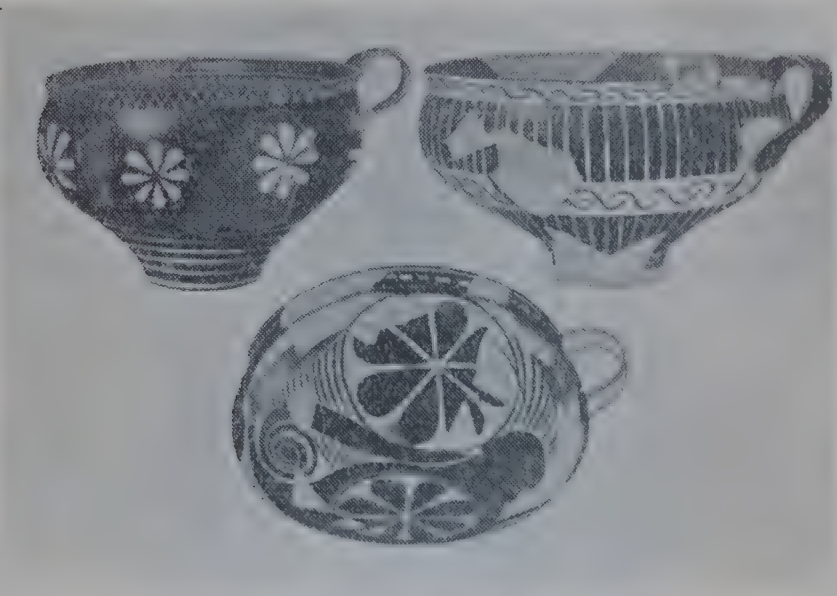


Fig. 15.—CRETAN VASES (KAMÁRES)

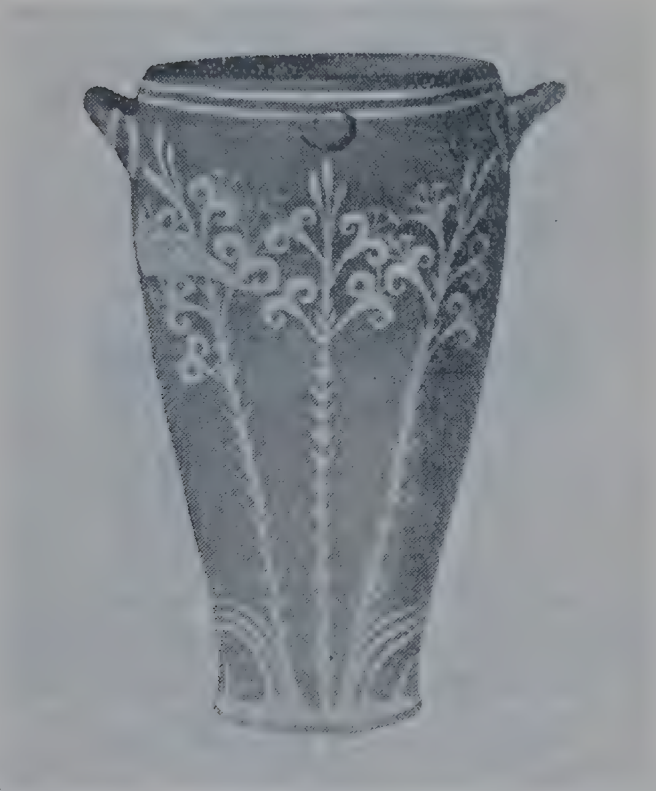


Fig. 16.—MIDDLE MINOAN VASE

forms. A similar classification has been noted for the mainland of e, and is known as early, middle and late Helladic (*see Figs.* 15, 16, and 17*b*).

s evident that this general classification must prove of the highest to excavators and to students, and affords clear criteria for estimating the age and affinities of any deposit. Any study of the subject, t profitable, must of course be supplemented by actual familiarity typical instances of all classes. This can best be obtained in the muse of Candia and Athens. But selections of fragments and of facsimiles

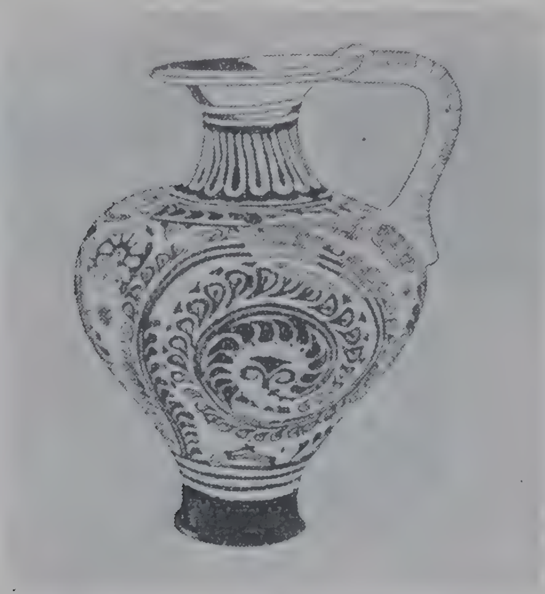


Fig. 17*a*.—LATE MINOAN VASE

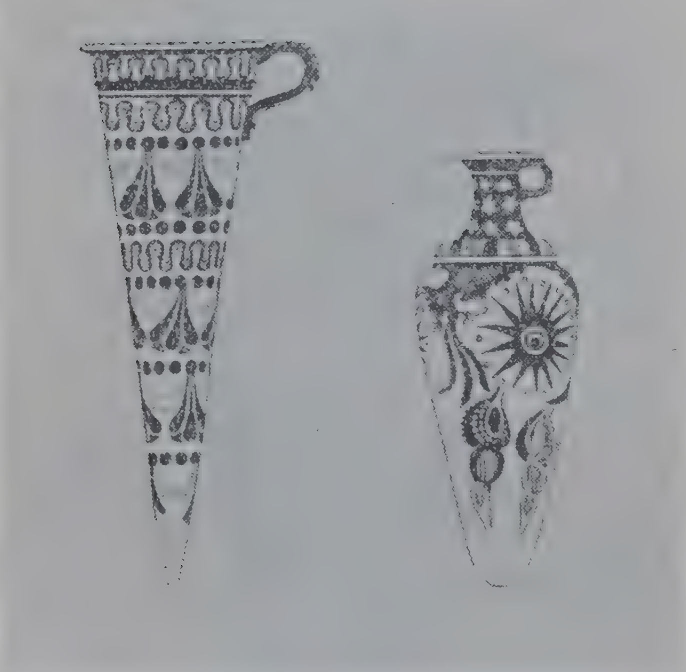


Fig. 17*b* —LATE MINOAN VASES

been arranged in Oxford, at the British Museum, and elsewhere, so th is possible to grasp their main characteristics without a visit to Ægæan.

GEOMETRIC AGE

Following on the decadence of the Minoan and Mycenæan civi tion, we find new elements of decoration intruding into the potter Greece. These belong to what is called the geometric style, in the ricted sense. The supplanting seems to have been gradual, for vases fragments of the late Mycenæan and the early geometric are often nd side by side both in Crete and on the mainland of Greece. The in of this geometric style has been much disputed; there are two main ories, the one that it was brought in by the invading Dorians about o B.C.; the other that it represents a revival of the earlier geometric e which had been overwhelmed for a time by the Mycenæan. This metric pottery is found in many places, above all on the Acropolis of ens and in the cemetery just outside the Dipylon Gate, whence it is monly known as Dipylon ware (*see Fig.* 18). It often consists of very e vases, which were set up as monuments over tombs as well as ied within them. The subjects are not confined to stylised patterns

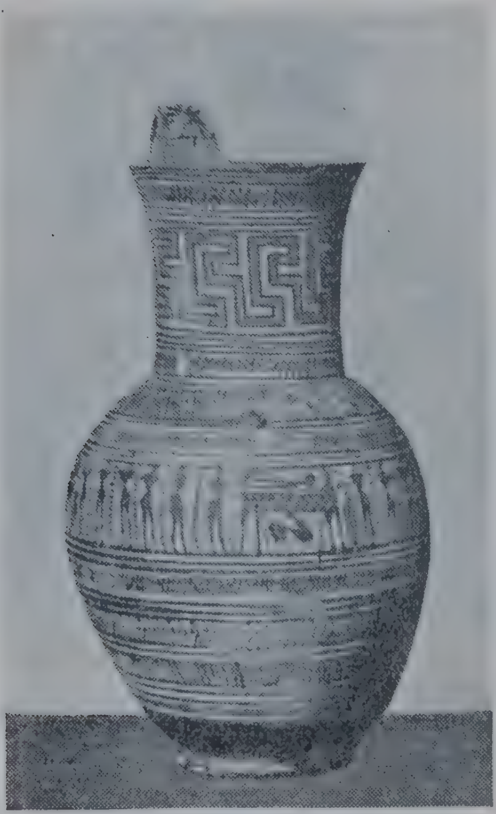


Fig. 18.—GEOMETRIC VASE, DIPYLON

as the key, a kind of flattened spiral or mæander, or concentric es connected by tangents, but also include aquatic birds, deer, and r animals; and in the more elaborate specimens are found figures of es and men, great funeral processions, dances, and even sea-fights. geometric pottery, which reaches its full vigour in about the ninth eighth centuries B.C., comes almost everywhere, in its later phases, to enetrated by orientalising influences. This is the case especially in a and Bœotia, and in what is called proto-Corinthian, which is ly spread in minute and delicate vases. Much of it was found in the æum at Argos, and more recently at Corinth and its neighbourhood. olouring and in shapes of vases it recalls the later varieties of the enæan, and may well have been developed from it, side by side with eometric intrusion.

The orientalising style, which is in vogue about the seventh and s centuries B.C., falls into two main branches, the Doric or Corinth and the Ionic or Rhodian, the former mainly prevalent on the mainl of Greece, the latter in Asia Minor (*see Fig.* 19). It may be said gener that the Corinthian is more compact in its shapes and more crow and concise in its ornamentation, and given to the rendering of de by incised lines, the Rhodian or Asiatic freer and more flowing in de and given to the use of outline. Both alike have the ornamentation larger vases in the form of friezes one above another. The subject earlier examples are mainly friezes of animals either real or fanta ibexes, oxen, lions, leopards, birds, and sphinxes, gryphons, and o mixed forms. In both the human figure appears on later examp sometimes merely for decoration, sometimes in definite scenes of com or of mythological interest. Both styles develop on lines consistent their character. The richly decorated and freely drawn work of Mil and Rhodes is continued in the various Ionic schools of paint At Clazomenæ many large terra-cotta sarcophagi have been fou some with historical battles—the finest is in the British Museum. T style is continued with some Egyptian influence in the pottery fo on the site of Daphnæ in the Delta, where Psammetichus settled Ionian mercenaries ; this was deserted after 564 B.C., when Amasis tra ferred the Greeks to Naucratis, and consequently all the pottery fo

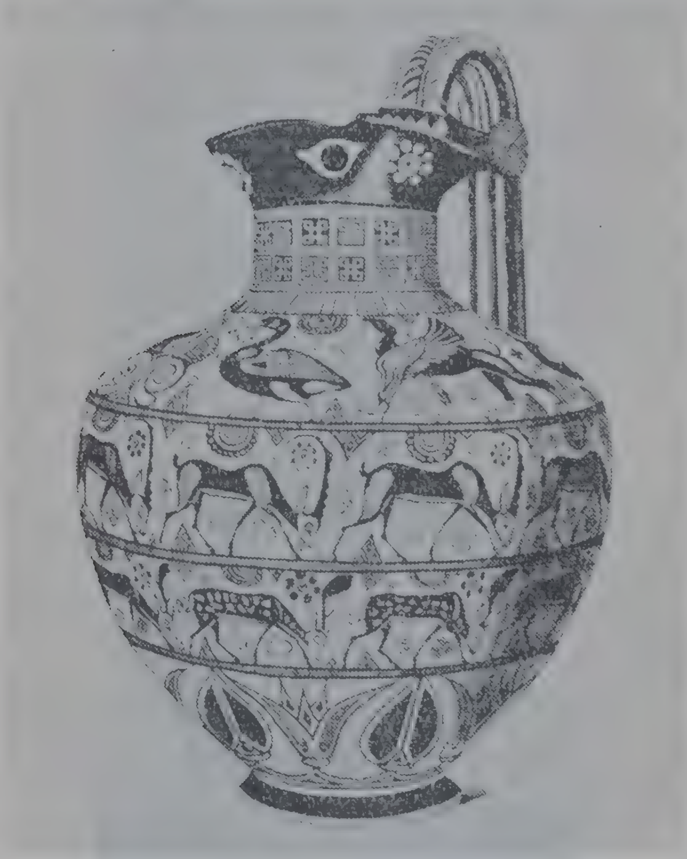


Fig. 19.—RHODIAN VASE

:e, which is very distinctive in style, must belong to the end of the enth century or the beginning of the sixth. Naucratis also developed a racteristic vase painting, derived from that of Miletus and Rhodes. eat quantities of this pottery were found in the temples sacked by the sians in 526 B.C.; hence this Naucratis ware must belong to the third rter of the sixth century. Such historical data offer most valuable lence as to the dates of the various classes of vases, not only of those le at Daphnæ and Naucratis, but also of those showing affinity to n or discovered with them.

STYLES OF GREEK VASES

ı addition to the Corinthian, which are the most numerous and wide- ead, there were other distinctive classes of vases made on the main-

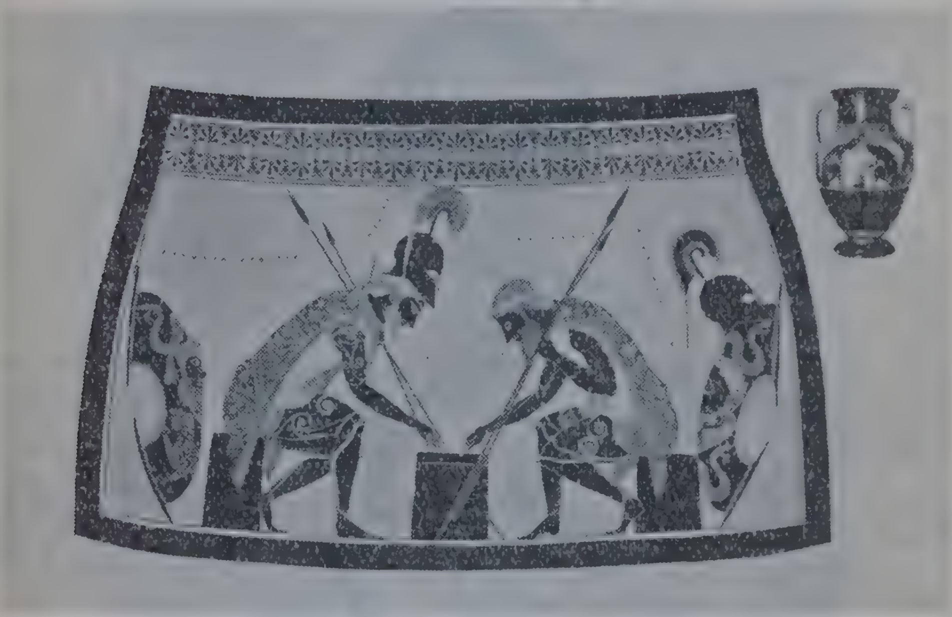


Fig. 20.—BLACK-FIGURED VASE. HEROES PLAYING DRAUGHTS

of Greece. Among these are the Chalcidian, noted for its metallic s and quaint and vigorous drawing, and the Attic or Athenian. se and the later Corinthian all adopted a style of decoration with figures on a terra-cotta ground, drawn in silhouette with all de- incised; white and purple were also added in places. These black- ed vases, as they are called, became very popular throughout the iterranean, and were exported in great quantities to Italy and else- e. Many of them were found buried in Etruscan tombs. Hence they, the red-figured vases that succeeded them, were usually called uscan" vases by the antiquaries of a century or more ago. This -figured style was prevalent in the earlier part of the sixth century B.C. her class of vases which had a more or less independent develop- was that of Sparta. Thanks to the careful record kept of the stratifi- n of the vase fragments in the temple of Artemis Orthia, this nian ware can now be traced through the centuries, from the seventh fourth, in different stages of rise and decline. Its finest work, which gs to the sixth century, has a fine white surface and beautifully de- d ornamentation; its scenes are in the black-figured technique.

From the subjects on some of these vases, they were generally suppo
to be of Cyrenaic origin. This is clearly not the case, in view of
Spartan discoveries, though it is still possible that some of the vases n
have been made by potters who carried the Laconian tradition to Cyre
In the sixth century Athens, with its famous potters' quarter (Ceramicu
began to monopolise the Italian market, and to drive the Corinthian
other rivals from the field. From about 550 B.C. onwards the history
vase-painting is the history of Attic vase-painting. For the two centu
that follow the study of this history has become highly specialised. B
potters and painters took to signing many of their finest vases ; and, w
the help of their signatures, the vases have first been classified accord
to these ; then others have been grouped around them by compara

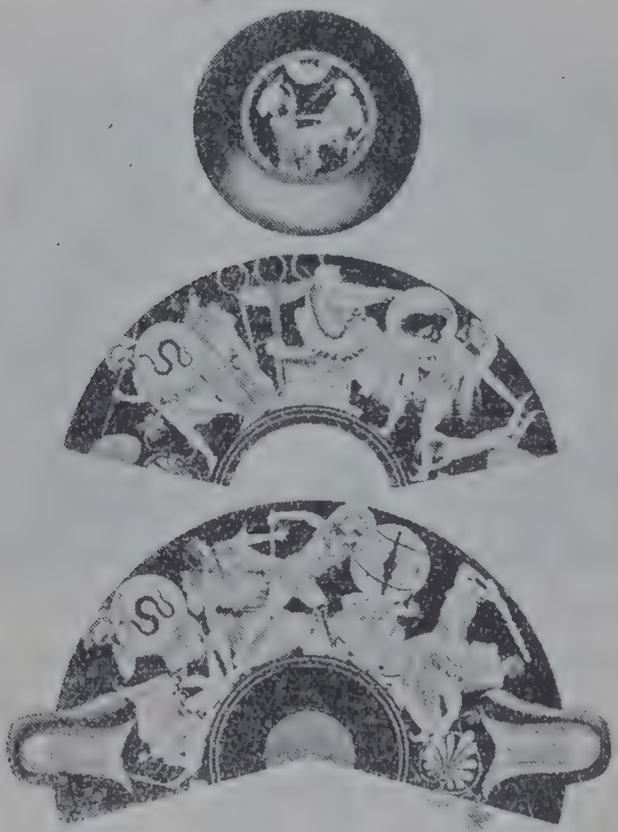


Fig. 21.—RED-FIGURED VASE, BY BRYGOS
SACK OF TROY

study, until it has become possible to assign a very large number not
to their date, but also to their individual master. Certain general char
may be noted. The finest of the Attic black-figured vases had a
design and exquisitely finished detail, incised almost like goldsmith's w
(*see Fig.* 20). Other examples vary in excellence, and some were carele
drawn. About the last quarter of the sixth century a revolutionary cha
in the design of vases was introduced. Instead of the figures being
houetted on a light terra-cotta ground, the figures were first drawn
outline and then the background was blacked round them, all de
and inner markings being rendered by fine brush-lines, often in relie

surface. It was in this red-figured technique that the most skilful
-painters worked, and drew with a freedom of design and a cer-
ty of hand that have never been surpassed (*see Fig.* 21). The actual
s of these different techniques were incorrectly estimated by earlier
ents, owing to the misconception that the finest vase-painting must
pproximately of the same date as the finest sculpture in the Parthenon.
once more a national disaster came as a help to modern study. For
e débris buried on the Acropolis after the Persian sack of Athens,
e were found signed vases by the greatest artists of the finest red-
ed technique, which must therefore have been fully developed before
B.C., and must probably have originated some half-century earlier.
vase-painting continued to develop, though hardly to improve, after

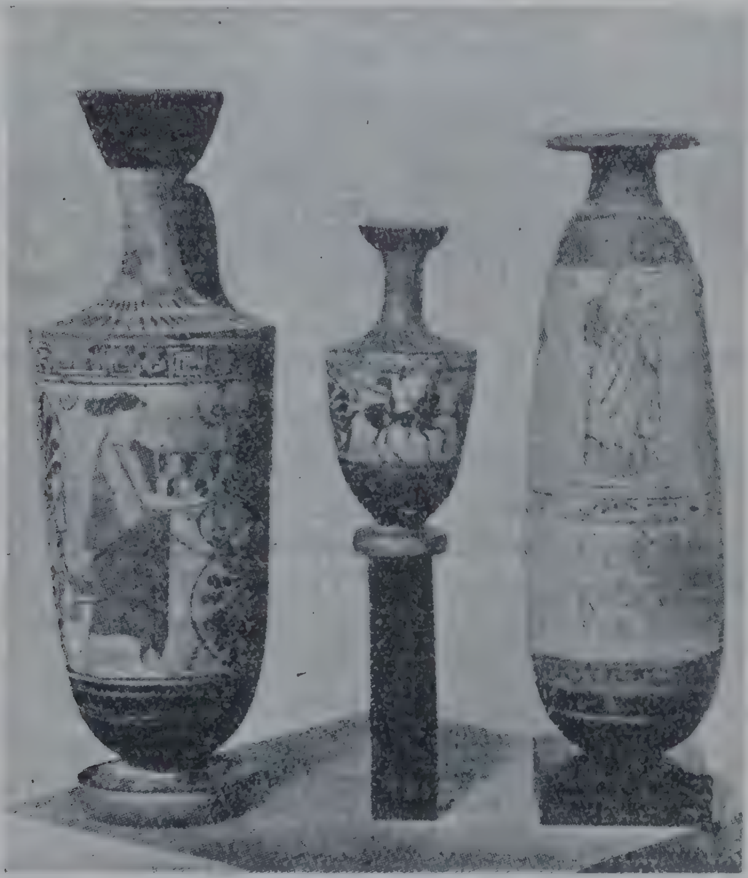


Fig. 22.—ATTIC WHITE LECYTHI

eriod. A strong influence was exercised by the painter Polygnotus,
came to Athens soon after the Persian invasion and painted many
us frescoes of historical and mythological scenes. The simple and
fied drawing, and the distribution of the figures as if on uneven
d, is imitated on some vases of this time, which may therefore give
ne notion of his style. Towards the end of the century a more florid
icturesque effect is aimed at. A series of vases which lasts pretty well
gh the fifth century B.C. is that of the Attic white lecythi, or vases
ntments buried with the dead. These were painted in more or less
hrome effect upon a white ground; they can therefore give us a
notion than the red-figured vases of the arts of fresco and easel
ing as practised at the time (*see Fig.* 22). In the fourth century the
vase-painting in Athens lost its distinction and brilliance; but it

produced for the barbarian market, especially the Crimea, vases v
coloured and gold enrichments ; and some interesting imitations v
Scythian subjects seem to have been made locally. But the South Ital
at this time took to making vases for themselves instead of impor
them. At Tarentum, in particular, enormous and pretentious vases v
produced, often with interesting scenes from dramas or from the ne
world of the dead. There were several other varieties of Italian va
such as Apulian, Lucanian and Campanian, which did not entirely
appear until the Roman conquest.

This is an outline of the history of Greek vase-painting, and eno
has been said to show how such a series of datings of various st
checked again and again by reference to historical events, offers a c
stant succession of clues to the excavator and to the student. In o
that these clues may be preserved and understood, the most careful
cord must be kept in all excavations. If the earth in which objects
buried is the result of gradual accumulation, it must be removed an
corded stratum by stratum. If its burial has been the result of sud
destruction or accident, the exact conditions must be considered ; if
excavation is of a cemetery, the contents of the various graves mus
preserved together and their relative position noted.

PRESERVATION AND RESTORATION OF VASES

The study of Greek pottery has so far been considered almost ex
sively from the artistic and technical side, and especially from the chro
logical data it supplies. From this point of view, the most insignifi
fragment can give as trustworthy and valuable information as a comp
masterpiece of the vase-painter's art. The subjects of vase-paintings
an almost inexhaustible field of study, ranging from gods, heroes
mythological scenes to the most trivial details of daily life. But be
making use of this evidence as to the way the Greeks represented
themselves all these subjects, it is necessary to observe some caut
The history of the preservation and present condition of Greek vas
similar on a small scale to that of Greek sculpture. The vases were
up in great quantities in the eighteenth century in tombs, mostl
Etruria, and accordingly were commonly called Etruscan. They
sought after by rich collectors, either for ornamental purposes o
works of beauty in themselves ; but they remained almost entirel
private collections. For such purposes broken vases or fragments
little attraction. Many vases, thanks to the solid construction of the to
remained whole and undamaged. Many others were broken up, and
tions of them were lost. Here the restorer again had his chance, an
used it sometimes with skill and discretion, sometimes indiscrimina
The reconstruction of the form of a vase, of which considerable port
are missing, requires skill and patience, but is in every way a desir
undertaking, especially if the new parts be distinguished from the
by some difference of colour. Restoration of the designs or scenes re
sented on the vases is another matter, and may be very misleading.
instance, on a vase from the Leake collection at Cambridge there w
representation of Ulysses and a companion thrusting a club into the

'olyphemus. When the vase had been skilfully cleaned, the club dis-eared, and there were left only two warriors attacking with spears a ımbent giant, probably Heracles and Telamon attacking Alcyoneus. : Cyclops motive was borrowed from another vase in the British seum. This is a very simple and insignificant instance of false restora- ; but it would be easy to multiply examples in which what is now ɔle is a mere travesty of the original design. Nor is the pernicious k of the restorer confined to modifying the composition or adding to Vhen vases had been broken into many fragments and pieced to-ıer, often the joints were scratched in and then filled up with cement or e other material, and then the whole was covered over with an opaque of pigment, only approximately resembling the terra-cotta red and k of the original painting, so as to conceal the fact that the ware had ı broken and put together again. Most of the vases in the great col-ons have been tested and cleaned by experts, so that what is now ɔle is ancient; but there are many still left which would not stand the or of which but a small portion would survive it.

reek vases, like Greek sculpture, were for a long time accessible only ıe few. Systematic study of them was facilitated by the transference ırge series of them to public museums. Thus the Hamilton collec- of vases was acquired by the British nation in 1772, and was later ed by many additions. The great Campana collection was not ac-ed by the Louvre until 1861. There are now fine collections of vases ıost of the chief museums of Europe and America. Catalogues of y of them have been published; and within recent years a great in-ational project for the publication of a systematic "corpus" has ı planned and is being rapidly carried out.

SUBJECTS OF GREEK VASES

ıe subjects of the designs on Greek vases and their interpretation attracted much attention from scholars. In earlier days fanciful ınations and attempts to connect them with the mysteries were pre-ıt. Some undoubtedly preserve for us aspects of Greek religion and otherwise unrecorded; but mythology itself in recent years has be- a more scientific and comparative study. Some of the commonest es of subjects may be noted. In some cases they illustrate, or con- the information we obtain from classical literature, in others they lement or modify it. They are sometimes derived from scenes of ı or of ritual which are preserved through no other channel; even ı they reproduce a well-known tale, they often do not merely illus- the text, but give a traditional and independent version of the story. equent characteristic is the desire to tell as much as possible of the in a single scene; and this not by repeating the same figure in suc-ve stages of action, but by what is sometimes called the comprehen-method, by grouping together several incidents without very close vance of the unities of place or time. An example may be seen in epresentations of the sack of Troy. Here the various episodes were known. Neoptolemos slew Priam at the altar in the palace; he also l Astyanax by hurling him from the battlements. But the figure of

Neoptolemos appears only once, and he is hurling the boy, not over battlements, but against the altar on which Priam is seated. There many varieties of this scene in detail, but the combination of the tragic events had evidently become impressed upon tradition, thoug does not appear in any literary version of the tale. And, to fill up the ture on the vase, other episodes were introduced as required to fill space or to satisfy the artist's caprice—Ajax dragging Cassandra from image of Athena, the Trojan women taking refuge at the same statue, escape of Æneas, carrying his father on his shoulders and leading child, the rescue of Æthra by her grandsons. These do not recur in traditional order, but are selected and arranged by the vase-painte suit his convenience or to balance his composition.

The gods are frequently represented on Greek vases, either in si figures or in groups, or as taking part in some scene or action. Someti comprehensive groups of the chief gods are found, usually arrange pairs ; but there is no recognised canon of choice. They may be re sented as banqueting on Olympus. Such groups are especially comn when a great occasion is represented, such as the introduction of Hera and his marriage with Hebe after his apotheosis, or the return of He æstus when he was brought back by Dionysus and his satyrs. The b of Athena from the head of Zeus occurs in the presence of other g and her combat with Poseidon for the land of Attica. She also app constantly as supporting heroes in their various exploits.

A scene of combat in which all the gods take part is the battle of g and giants ; and the separate single combats of the various gods and gi often appear.

The myths relating to Apollo and Artemis frequently appear on va Apollo rescues his mother from the giant Tityos, whom he slays. Ap and Artemis, instigated by their mother, slay the children of Ni When Marsyas, having picked up the flute invented by Athena, challen Apollo to a musical contest, he is defeated and flayed for his presumpt Artemis, surprised while bathing by Actæon, sets his own hounds him. Apollo recovers his cattle, which had been stolen by the in Hermes. Dionysus, with his rout of satyrs and Mænads, is perhaps commonest of all subjects on vases, and appears in infinite variety. myths of Demeter and Persephone also supply many themes. The of Persephone by Pluto is not often found ; but, on the other hand, return of Persephone to her mother and to the upper world occur many varieties of treatment. Sometimes she appears emerging from earth or from a cave, escorted by Hermes as messenger and guide. curious variation she is welcomed on her return, or at least surroun by satyrs or peasants with mallets—apparently a reminiscence of s country festival. In one case she is named Pandora and received Epimetheus. In some vases, which contain Eleusinian gods and her the birth of Plutus is represented. A large and sumptuous series of va mostly made at Tarentum, in South Italy, represents the underworld the midst, in a palace or shrine, are placed Hades and Persephone, rounded by other figures of the world of the dead—the three jud Minos, Æacus and Rhadamanthus, Orpheus and Eurydice, Medea her children, Theseus and Pirithous, and also the great sinners, Sisyp

Tantalus, tormented by Furies. Among them sometimes appears
acles dragging off Cerberus.

cenes from the life and exploits of heroes supply many subjects to the
-painter. The commonest of all, perhaps, are the Labours of Heracles.
addition to the canonical twelve, each of which has more than one
gnised version, various other exploits or adventures are represented.
ong them are his visit to Egypt, and overthrow of Busiris, his slaying
he giants Antæus and Alcyoneus—these in addition to his taking a
ılar part in the battle of gods and giants; his fight with Cycnos and
s, which is often hard to distinguish from a battle of gods and giants,
e most of the gods join in on either side until Zeus parts the com-
ants; his struggle with Triton, and also with the river god Achelous,
which last he won as his bride Deianira, whom he subsequently de-
red from the centaur Nessus. He also fought with the centaurs and the
azons, and freed Prometheus from his fetters on the Caucasus, after
ing the vulture that tormented him. A latish vase, of Italian make,
resents his madness as it is told in the play of Euripides. This is but a
ction from the great variety of adventures in which Heracles is the
n figure. Theseus, especially in Athens, had also a canonical series of
loits, mainly on his journey from Trœzen to Athens; the club-man,
pine-bender, the sow, the wrestler Kerkyon, Sciron, who hurled
ellers down the rocks that bore his name, Procrustes, who cut them
n to fit his bed, all of them suffered poetic justice at the hands of
eseus. But his chief exploit was the slaying of the Minotaur in the
yrinth, after he had accompanied the annual tribute of children from
ens to Crete. There are also representations of his visit to the home
mphitrite beneath the sea at the challenge of Minos; of his receiving
n Ariadne the clue to guide him through the labyrinth, and his deser-
of Ariadne in Naxos. Theseus was, above all, an Attic hero; but the
c vase-painters also illustrated many other legends. One of the most
iliar is that of Perseus. We may see on vases Danaë receiving the
wer of gold, and being enclosed in the chest and floated off to sea.
ny of the details of Perseus' seeking and slaying of the Gorgon Medusa
to be seen. A favourite subject, especially on early vases, is the flight
he hero across the sea, pursued by the other two Gorgons. Then there
he rescue of Andromeda from the sea-monster, the return home, and
turning of Polydectes to stone by means of the baleful head. Another
t expedition was that of Jason and the Argonauts to recover the
len fleece; this offered many subjects to the vase-painter—the freeing
Phineus from the Harpies by the sons of the North Wind; Medea's
to Jason in overcoming the dragon; her adventures after she had
to Greece with Jason; her destruction of the bronze man Talus, who
nded the shores of Crete, and her deception of the daughters of
as; finally her quarrel with Jason and slaying of her children, as
esented in the play of Euripides.

he Theban legends are not very commonly found on Attic vases,
haps because no love was lost between Thebes and Athens. Œdipus
the Sphinx appear on an Ionic vase. The tale of the Seven against
bes has inspired a quaint picture of the bribing of Eriphyle; Poly-
s tempts her with the necklace of Harmonia, and on a Corinthian vase

with the departure of her husband Amphiaraus the necklace she h tells the tale of her treachery. Dionysiac scenes are not particularly sociated with Thebes, except in the case of Pentheus.

This miscellaneous set of legends, many of which are only incide ally referred to in literature, might be almost indefinitely multiplied. enough has been said to show the vast repertory from which the v painter could select. In addition there are all the vases which deal w the tale of Troy, as told in the poems of the Epic cycle, and especially Iliad and Odyssey. These start with Peleus' capture of the sea-godd Thetis, the marriage feast at which the dispute arose between H Athena, and Aphrodite, and the judgment of Paris that followed—a the repeated again and again in various types. Then follows the elopemen Helen with Paris. The Iliad inspired many scenes which, apart from names added, could not be identified with certainty ; for one battle sc is much like another. Often we simply find single figures or small gro of heroes, such as Achilles and Ajax playing draughts, or Achilles bi ing the wound of Patroclus, or the separation of Hector and Ajax a their single combat. The capture of Dolon, the embassy to Achilles, attack on the ships, are all clearly represented ; also Sleep and De carrying away the corpse of Sarpedon. The final duel of Achilles Hector is identified by the names, but the details of the Homeric narra are not followed by the artist. The dragging of Hector's body, and Pria visit to Achilles to redeem it, add pathos to the story ; and there are presentations of Hector and Andromache, alone or with other Troja The Odyssey, from its varied and distinctive episodes, is easier to ill trate than the Iliad. Among characteristic scenes may be quoted the ventures with the Cyclops, with Circe, and with the Sirens, the visit the region of the dead to consult Tiresias, the meeting with Nausic the loom of Penelope, the recognition of Odysseus by his old nurse A ticleia, and the slaying of the suitors.

Historical scenes are sometimes found on vases ; but mostly such had already become almost mythical in character. Thus the represen tion of Crœsus seated on his funeral pyre does not correspond clos either with the account in Herodotus or with that in Bacchylides. Co bats of Greeks and Persians occur on vases, but the great example of imaginary historic scene is the vase at Naples which represents Ki Darius and his Court making preparations for the invasion of Gree This was made in South Italy, probably about the time of Alexand when people were reminded by current events of the time of the ol Persian wars.

Scenes from daily life are very common on vases, and serve to illustr almost every form of work, activity, or enjoyment. The art and pract of the potter himself is not neglected ; we can see representations quarrymen chopping out clay from the pits, of potters throwing va upon the wheel ; of the furnace with vases being baked in it, of the va painter's studio, with master and apprentices at work ; and, finally, the vases being exported by ship, sometimes hung in the rigging to av risk of breakage. Agriculture is represented by ploughing and sowi by the gathering of crops of olives, apples, and other fruits, and by sce of vintage and wine-presses. Among trades and occupations we fi

e-making and shopping. Many vases, as was to be expected, are con-
ned with athletics, and almost every type of contest is found—run-
g, jumping, wrestling and boxing—in addition to chariot and horse
es. A class of vases, known as Panathenaic amphoræ, were given as
es in the Panathenaic festival at Athens. These have a large image of
ena on one side and on the other a representation of the contest for
ch they were given. They were evidently highly prized by the victors,
hey were exported to all parts of the Greek world. Dinner-parties, sym-
a, and dances are often found in vase pictures, and also many games ;
etimes there are religious processions and festivals, military exercises
reviews. Funeral rites are especially found upon vases made for plac-
in tombs or dedicating outside them, such as the Athenian white
thi ; on them may be seen the lying in state of the corpse (prothesis)
ounded by mourners, the funeral procession, the deposition in the
b, sometimes by figures of Sleep and Death, and the approach of the
ivors with offerings to be placed in the tomb, usually wreaths or
es. In short, there is hardly any event of interest which cannot be
trated from vase-paintings, or about which they do not give us valu-
information.

USE OF VASES

is sometimes asked what use the Greeks made of painted vases. A
ain misapprehension arises from the fact that the great majority of
vases in our museums have been found buried in tombs. Certain
ses of vases were certainly made for the purpose of burial with the
l, owing to the custom prevalent in many places and periods of sup-
ng vessels and furniture for the dead in their long abode. But repre-
ations on the vases themselves often show them as in actual use or
ding about in a house ; the dead were merely supplied with what they
used to in life. Doubtless the larger and finer vases were intended
er for ornament or for dedication in temples ; an immense number
ase fragments of all periods were found on the Acropolis at Athens,
in the temples of Apollo and of Aphrodite at Naucratis ; owing to
conditions of destruction and discovery, it was inevitable that such
cated vases should be broken up and only survive in fragments. But
can be no doubt that the vases were originally intended for actual
though many of them, owing to the demand for vases to be buried,
provided for the export trade to Etruria and elsewhere.

GEMS

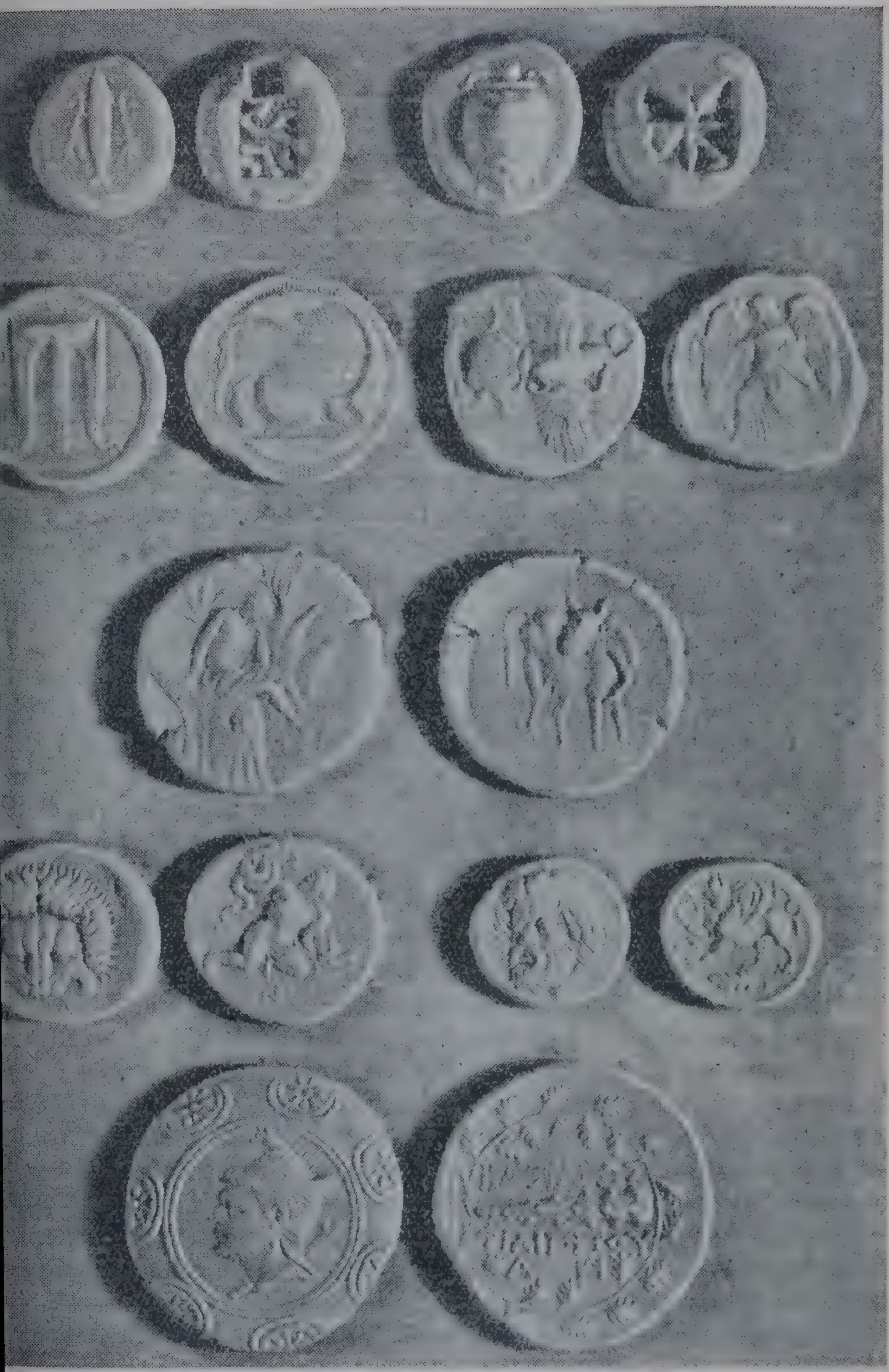
wo classes of antiquities that are closely related, from the artistic point
ew, are gems and coins ; for the coin, in its essence, consists of a lump
etal stamped with the seal of a city or a ruler. Gems may be either in
ious or semi-precious materials, and in harder or softer stones. The
aved design is always in early times in intaglio, or cut in so as to pro-
an impression in relief on wax, plaster, or some other soft material.
usual form of a seal-stone in Mesopotamia was the cylinder, from
h the design could be rolled out on to the impression, and repeated
ically if required. The Egyptian form was the scarab, so called be-
the rounded back was carved to represent the folded wings of the

sacred beetle, the design being incised upon the flat side. Both forms w used in Greece in early times, and the shape of the scarab was often us in the finest period of Greek art, especially in what is called the sca bæoid, which preserves the shape but omits the details of the beetle.

Cretan gems, which are very numerous, are often in the earlier examp pyramidal in shape. In the later Cretan and Mycenæan gems the sha is often circular or else lentoid (lentil-shaped), and convex on both sid The designs found in Crete are often religious or symbolical in natu many of them containing symbols in the Cretan script. Mycenæan ge are more given to representations of animals, often in contorted positic —lions, oxen, or deer. The harder stones, which were worked with wheel, are most skilful examples of the gem-cutter's art. Gold signet ri have also been found, especially at Mycenæ, with more or less elabor scenes upon them. After the Mycenæan period comes that of the isla gems, mainly found in Melos ; these carry on the tradition, but in sof stones and, for the most part, less skilful work. They offer, howeve most valuable link between the Mycenæan and the archaic Greek. T art of the Greek gem engraver goes through much the same stages as t of the sculptor and painter. In the earlier time it is stiff and angular poses ; in the fifth century it attains the highest degree of beauty of sign and technical skill ; in later times it becomes softer and freer in sign. Cameo cutting, in which the figures stand out in relief, often differently coloured layers of stone, does not appear until the Hellenis age. Some very large ones were made with Ptolemaic portraits, as w also large allegorical groups ; the same technique was continued w great sumptuousness in Græco-Roman or Roman imperial art. Gr gems have always been in great demand among collectors, and for t reason many forgeries have been produced.

COINS

The study of numismatics is far too complicated to be more t touched upon here ; but Greek coins offer such invaluable evidence to art, history, and commerce that it cannot be altogether passed o (*see Fig.* 23). It is difficult for us to realise how great and prosper civilisations can have been carried on in early times before the invent of coinage ; all commerce must have been dependent either on barter on carrying about gold and silver ingots and portable scales. Units value were often slaves or cattle. In a very early Greek inscription Crete, fines are reckoned in tripods and caldrons. It has been sugges that the earliest Greek coins were equivalent to a bull. The inventior coinage was attributed by tradition either to the Lydian kings—one whom was Crœsus—or to Phidon of Argos, who struck coins in Ægi The essence of the invention, which probably dates from the seve century B.C., is the impressing on a lump of metal—in early times usu gold or silver, or electrum, an alloy of the two—a device or symbol wh was officially recognised as a guarantee of the weight and quality of metal, and so obviated the necessity of weighing or assaying it. T enormous variety of Greek coins that is known is due to the fact t every independent Greek city claimed the right to issue coins, and m



g. 23.—COINS OF CYZICUS, AEGINA, CROTON, ELIS, GORTYNA (CRETE), SAMOS, PANTICAPÆUM, MACEDONIA.

of them exercised this right and vied with one another in the beauty variety of their types. The origin of these types has been a matter of m dispute. Some authorities have regarded them as religious; and this se the obvious explanation when the head of the chief deity of the appears on its coins, as is the case with Athena at Athens, Hera at Ar or Zeus at Elis. Others are generally regarded as commercial, especi when the type represents the chief product of the city, like the tunny- at Cyzicus, the ear of corn at Metapontum, or the Silphium, a medic plant, at Cyrene—though in this last case the head of Zeus Amn appears on the other side of the coin. Probably no one explanation fit cases, but various local or other considerations led to the choice of device, or "arms," of the city which was placed upon its coins; so times it seems to be merely what is called in heraldry a "canting" vice, as when the parsley leaf appears on the coins of Selinus or the on those of Phocæa, "Selinon" meaning parsley and "Phokos" a s

The difference in shape between ancient and modern coins is ma due to the process of striking. First of all a metal die was prepared engraved in intaglio, just like a seal-stone. This was fixed in an anvil, then blanks of gold or silver or other metal were cast, of the requ weight, usually round or lentoid in shape and convex on both sides. T were driven into the die by means of a punch and a hammer. This pu except in the earliest examples, had another device engraved upo and thus were produced the obverse and reverse designs. The relief usually much higher than on modern coins, and consequently anc coins could not be piled, though in later times they became flatte surface. In early South Italian coins, the obverse design was often peated in hollow relief upon the reverse, the punch being in relief not in intaglio. No collar was used to prevent the blanks from sprea when struck; hence the irregular shape often found in Greek coins. the height of the relief gave the utmost scope to the skill and taste o artist, and contributed to the extraordinary beauty of many Greek c

The earlier scholars gave much study to Greek and especially to man coins; but in this case also the last half-century has seen great gress, and much co-operation. The great collections have been scient ally catalogued. Above all, a minute study has been made of the coi of various cities, all the historical data have been brought into rela with the indications to be found upon coins, and the successive per of the history of the city have been traced in its coinage. This is conspicuous in the case of outstanding events; for instance, Syra issued two magnificent series of dekadrachms to commemorate two g deliverances from its enemies—the Carthaginians in 480 B.C. and Athenians in 413 B.C., and the same city placed the Corinthian Peg on its coins when Timoleon from Corinth came to their aid; or, ag the introduction of the Samian lion's scalp on the coins of Rhegium Messene is probably to be explained by the arrival in these towns party of exiles from Samos in 493 B.C. And political conditions like Bœotian League or the Ionic revolt have left their traces on the coi of the cities concerned. Many other events, some of them recorde literary history, some otherwise unknown, are reflected in the histor coin-types. It is evident that coins have in this way contributed in

;hest degree to the certification and supplementing of history, and ɔve all to the exact dating of many events. The different monetary ndards used by different cities have been thoroughly studied, and most portant inferences drawn from them as to commercial relations, trade ıtes, and influences. Coins offer a dated compendium of the history of from the seventh century onwards. Many statues have been identified their help. From the time of Alexander, they also supply a vivid and hentic portrait gallery of Hellenistic rulers, which is continued in the traits of Emperors on the Roman imperial coinage. In addition to at may be learnt from their types and inscriptions, the evidence of ns is most useful when they are found, either individually or in hoards, excavations or elsewhere; they offer the same indications for dating vase fragments, but under even more precise conditions.

MINOR ANTIQUITIES

The study of minor antiquities, such as bronzes, terra-cottas, and carv- s in bone and ivory, has also been systematised and become more exact recent times. The larger bronzes follow much the same development style as sculpture generally; but statuettes and decorative bronzes e been found in great numbers and classified according to their nnique, age and place of origin. This was especially the case in great avations like those of Olympia, Delphi, and the Acropolis of Athens; y carvings have been found at Ephesus and Sparta; terra-cotta uettes and other objects have been found in immense numbers upon ost all excavated sites and supplement or verify the knowledge we ive from other sources; they range from Mycenæan and geometric it through the classical age to Roman times. How much a study of se minor antiquities can contribute to our knowledge may be realised visit to the exhibition illustrating Greek and Roman life in the British seum in London or to similar exhibitions in American museums.

INSCRIPTIONS

nscriptions, both Greek and Roman, were not ignored by the earlier olars, but the gigantic project of gathering together in a corpus the le body of inscription dates from the earlier part of the nineteenth tury. Systems of writing appear to have been in use as early as 3500 B.C. Egyptian hieroglyphic and the Mesopotamian cuneiform (or wedge- ped) were, however, a mystery until comparatively modern times. It ne of the greatest achievements of the early and middle part of the teenth century to have deciphered and interpreted them. The first was given by the Rosetta stone, found in 1798, and now in the British seum. It is bilingual—that is, it contains versions of the same docu- t in Egyptian hieroglyphic (the system of the priests), hieratic or otic (the system of books or of the people) and Greek. This enabled mpollion and other scholars to recover the Egyptian language and method of writing it. The Egyptian and Mesopotamian scripts were mbination of ideographic symbols (each representing a certain idea) phonetic (each representing a certain sound). Other systems, such as Cretan and the Hittite, existed in the second millennium B.C. The first

people to have invented and used a purely alphabetic system of writ
were the Phœnicians, the earliest long Phœnician document being
Moabite stone, dated about 850 B.C., though some fragmentary inscr
tions may be considerably earlier. The Greeks borrowed their alpha
from the Phœnicians, with slight modifications, about the end of
seventh century B.C., each Greek city adopting it in a different for
and this local variation continued until about 400 B.C., after which c
the Ionic alphabet, which we use to this day in printing and writ
Greek, was generally adopted. The Roman alphabet was borrowed, w
some modifications, from that of Cumæ and other Chalcidian colon
in Italy.

Inscriptions served in ancient times as the chief means of public
both for information and for record. There is hardly any aspect of religi
or of public or private life, that is not illuminated by the evidence
inscriptions. As to religious matters, we find records of the worship
recognition by the State of various gods; the foundation, endowm
and administration of temples; and innumerable dedications of stat
and offerings of all sorts. Some are of great historical interest—for
ample, the names of the cities which took part in the battle of Plat
inscribed on the support of the tripod dedicated to Apollo on the oc
sion. This was set up at Delphi, and is now in the Hippodrome at C
stantinople. Another instance is seen in the Roman arms dedicated
Pyrrhus of Epirus to Zeus at Dodona after his Italian campaign. I
merous temples and precincts had their own regulations, which were
up in a conspicuous position. There were lists of priests and other offic
and regulations for their appointment, duties and privileges, and for ri
of all kinds, might be prescribed.

A peculiarly interesting set of inscriptions records the cures made
Asclepius at Epidaurus. There were also many private associations
religious purposes, each of which had its own prescribed constitu
and ritual observances.

On the political side, there are innumerable documents contai
decrees and laws of the various States. An early example is a code of l
found at Gortyna in Crete, with many details as to laws of inherita
It was the regular practice at Athens and elsewhere to inscribe
decrees of the Senate and people on marble, and to set them up in
market or some other conspicuous place. Public accounts and invento
of treasure were treated in the same way, as well as decrees and spe
cations of public works of all sorts and building accounts. We have,
instance, the accounts of the building and sculpture of the Parthe
and the Erechtheum. It was a common practice in Greece and in Rom
set up honorary inscriptions to men who had done good service to
State; and the office and privileges of proxenos (nearly equivalent
modern consul) were frequently given to those who had made themse
useful to another city. Artists' signatures have given much informa
about the history of sculpture. The whole system of the trainin
Athenian youths, which subsequently developed into the Universit
Athens, is recorded in the so-called Ephebic inscriptions. In some c
we find a direct historical record, like that which Augustus had set u
many cities, to record the chief events of his reign; this is comm

wn as the Monumentum Ancyranum, because the best known ex- ole of it was found at Angora (Ancyra). Inscriptions in many places e recorded the famous Edict of Diocletian, an attempt to fix the price ll commodities throughout the Empire ; this was in some cases in ek, in others in Latin. Tomb inscriptions are innumerable, many of n containing interesting epitaphs.

Iost of the above classification applies equally to Greek and to nan inscriptions. On the Roman side an immense amount of light hrown on municipal organisation and institutions throughout the pire.

Iilestones make it possible to trace the construction, direction and of the network of Roman roads. Military inscriptions are also very nerous. Many of them, as Dr. Haverfield says, " are absolutely devoid triking features. But when these hundreds are considered together become important. If you tabulate some hundreds or thousands of nplaces, you can trace the whole policy of the Imperial Government ne matter of recruiting. You can ascertain the answers to numerous ortant questions—to what extent and till what date legionaries were ed in Italy, what contingents for various branches of the service were vn from the provinces, and which provinces provided most ; how far vincials garrisoned their own countries, and which of them, like the ish recruits, were sent as a measure of precaution to serve elsewhere ; inally, at what epoch the Empire grew weak enough to require the stment of barbarians from beyond its frontiers." This is but one ex- le of the way in which a great co-operative effort can reach results ch no isolated study or chronicle of facts or theories could attain, how a few great leaders, followed by numerous assistants and dis- es, can give a new outlook and a new inspiration to whole spheres of lectual activity.

THE GREEK HOUSE

nother aspect of Greek life upon which much light has been thrown ecent excavations is the plan and character of the Greek house. The Cretan palaces, with their courts and complexes of chambers, work- s, and store-rooms, stand by themselves. But the less extensive and ler palaces of Tiryns and Mycenæ show already, in their court and opening out of it, the essential features of the houses and palaces ribed by Homer, and also of the Greek house of historic times. This lopment had been obscured by a mistaken notion that both of these lly consisted of two courts, one for men and one for women. This onception was based partly on the false analogy of Pompeii, where the courts (atrium and peristyle) follow a Roman type, partly on a mis- rstanding, or rather a misquotation, of Vitruvius. The excavations iene and at Delos have given us many examples of well-preserved k houses, mostly of the fourth century B.C. or later (*see Fig.* 24). But almost all conform to the type of an open court, usually surrounded peristyle in the larger examples ; out of this, usually at the north side to catch the sun and escape cold winds, opens a large chamber, with a pillared porch in front of it, used probably as a living-room lso for entertainments, and several other rooms beside it or around the court. There was often an upper story approached by a staircase. some cases this was assigned to the women, in others they had cert chambers reserved for them. But that they were regularly to be found the court is attested by literary evidence, though on special occasi they were probably confined to their own quarters. The decoration these houses, often in imitation of marble panelling, resembles wha found in the earlier style of marble painting at Pompeii.

From all these sources it is possible to realise something of the life the ancient Greeks. In the best days of Athens the duties of a citi took up most of his time—attending the public assembly, serving turn as a magistrate or juror, taking part in religious festivals, or be called out for military service. It followed that a man spent little of time in his house, which was mainly given over to the women, especi in the daytime; but many houses had a dining-room in which gu could be entertained, and such dinners, followed by symposia, we common feature of city life. Most men also passed a considerable port of their time exercising in the gymnasium. Country estates existed, these, as well as commercial pursuits, were mostly managed by o seers or agents with the help of slave labour. Hunting, especially the p suit of the hare on foot and with hounds, was a favourite pastime.

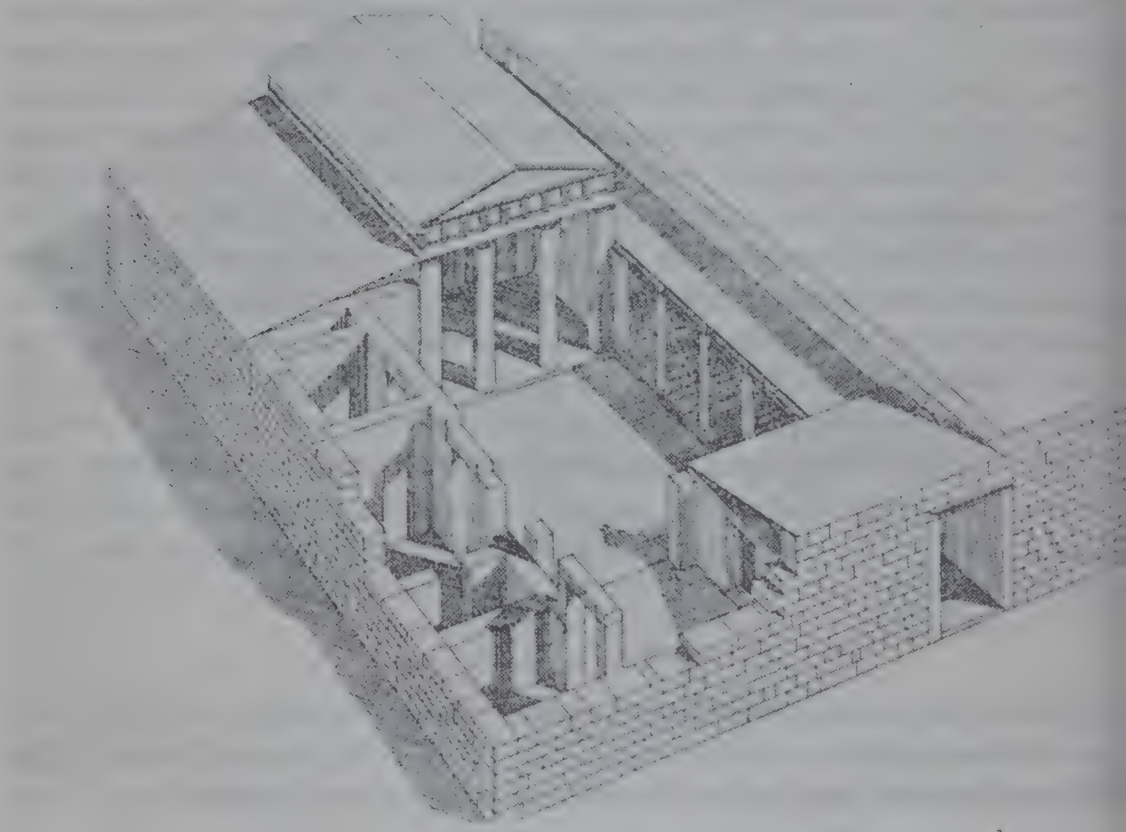


Fig. 24.—GREEK HOUSE AT PRIENE

ATTIC TOMBS

Another side of Greek life, which is little touched upon in literatur represented upon the reliefs set up over Attic tombs. These freque represent family scenes, and give a moving record of domestic affect ere is often either no reference to death, or only the most indirect sion. The survivors prefer to think of the deceased as they were when e, in their favourite pursuits or amusements. Groups of two or more res sometimes contain some allusion to a departure or a journey, in lemn hand-clasp and a gentle melancholy. These tomb-reliefs are not, rule, the work of great artists, but they are the product of a time when ek art was at its best, and they testify to the good taste and feeling he people as a whole. The greatest number of them was found in the amicus at Athens, just outside the sacred gate through which passed road to Eleusis.

MYTHOLOGY

nother study which, though it does not deal directly with visible and ible objects, is generally reckoned as a branch of archæology, is that ythology. The evidence of vase-painting as to this subject has already noted; reliefs also, especially votive reliefs, often give information erning local beliefs and rituals. The earlier mythologists were often ent to make fanciful explanations both of myths and of the ritual ciated with them, and often some theory, such as that of the solar h, was used almost as a universal key to their interpretation. But a ematic and comparative method of study has led to more scientific lts. The primitive rites practised everywhere by peasants, especially itical periods of the natural year, often bear a striking resemblance e tales that they tell, and also to the myths which we find in a more cial and poetical form in Greek mythology. Sir James Frazer's *len Bough* is an example of the mass of material that may be used in investigations.

NORTHERN AND WESTERN EUROPE

far we have been mainly concerned with classical archæology, but hs which fall within the historical period in Greece and Rome and e Mediterranean region must still be counted as prehistoric in the and west of Europe. Much study has been given to these, but much emains obscure; for instance it is still a matter of doubt, in the case e beginning and end of the bronze age and the beginning of the iron how far the advances made are contemporary in the Mediterranean n and in central and north-western Europe. The interval between wo is not probably so great as is sometimes supposed. For objects rter seem to have travelled along the great trade routes between the and the Ægæan in both directions. Baltic amber is often found e south from Mycenæan times onward; and Mycenæan patterns, or s closely resembling them, are found as far away as Celtic Ireland. most characteristic examples of the civilisation and handicrafts of regions are associated with the names of two places where they been found most abundantly: Hallstatt, in Austria, and La Tène, itzerland. The first, which belongs to the later part of the bronze s generally dated about 900–700 B.C.; the latter, which belongs to arly iron age, about 400–300 B.C., and both show the influence of an art of a contemporary or slightly earlier age. The metal objects of

these styles, and the pottery that accompanies them, have been p
lished and recorded, and supply a foundation for the study of the han
crafts of Scandinavia and Celtic Britain as well as for central Europe

This sketch gives an outline of the achievements of archæology. M
branches of the subject have been passed over altogether, others h
been but lightly touched upon, but enough has been said to show
the discoveries of the past half-century have been of the most remark
character, and exceed perhaps those of any other epoch in the histor
the study. Nor do these discoveries seem likely to be at an end or eve
have come to a pause. The last few years have seen the most sensati
finds in Egypt and Mesopotamia, and the limits of our knowledge s
to be pushed further and further back, to show even in the remotest
the most surprising technical and artistic attainments.[1]

MOST RECENT DISCOVERIES; EGYPT

In the case of Egypt, the life of the people has been recorded and
trayed with vivid detail in the paintings which decorated the inside o
tombs. These, owing to the dryness of the climate, have been prese
uninjured except by the hand of man, and have been studied and co
so that they are readily accessible to study. The same conditions
affected the preservation of many other objects, such as furniture
small articles of all sorts in wood or other materials elsewhere perisha
In earlier days it was mainly the pyramids and colossal temples w
impressed the imagination ; but little was known about the adminis
tion or civilisation of the country beyond what could be learnt f
Herodotus and other classical writers. The great mass of documents
has been discovered in recent years, both inscribed on stone, scrat
upon potsherds (ostraka), or written on papyrus, has supplied deta
information as to history, administration, religion and social life.
immense number of small objects, vases, beads, scarabs, ushabti
tomb statuettes), have been studied and dated according to their t
and materials, so that it is now possible to reconstruct in imagina
the characteristics of almost all periods, from the earliest to the l
dynasties. In addition to this, there have been made some special
coveries of extraordinary richness. One, which aroused the widest inte
was the tomb of King Tutankhamen, the son-in-law of the heretic Pha
Akhenaton. As a rule tombs in Egypt, especially those of the kings,
been rifled, many of them in ancient times, and only gleanings are lef
the modern excavator. Consequently the news that an unrifled tomb
been found aroused the highest expectations, and these were fully just
by the result. In the ante-room there was, closely piled together, a
mass of furniture, beds, chairs, chariots, and other objects, all of the
elaborate character and richly inlaid or plated with gold and
materials ; the style however lacks the severity and simplicity of ea
work, and shows the influence of the somewhat affected work made u
Akhenaton. Within the tomb chamber itself was a richly orname
shrine enclosing the actual sarcophagus, ornamented with winged fig

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[1] See also the section on Egypt and Mesopotamia in the Article on *The*
of Painting and Sculpture, p. 921.

ıardian goddesses, and plated with gold. The whole contents of the ɔ have now been transferred to the Cairo Museum, and probably titute the most remarkable set of objects ever found together.

he work of the time of Akhenaton shows a strange but most interg phase in the history of Egyptian art. This king, about 1400 substituted for the traditional worship of the Egyptian gods a kind ıonotheism, and appears to have attempted something of the same with the traditions of Egyptian art. This may be seen chiefly in sculpture and painting found in his palace at Tell-el-Amarna. portraits of the king and his family vary considerably, from a ed and spiritual idealism to what is hardly short of caricature. king's figure, for example, seems almost to be a pathological study ı abnormal development; but his face as well as that of his queen, must have been closely related to him, has a subtle charm, in of the abnormal development of chin and neck (*see Fig.* 25). The ative paintings of the palace at Tell-el-Amarna are also strangely e Egyptian work, especially in the naturalistic representations of s and animals. These last show a remarkable resemblance to conorary designs in the palace of Minos at Cnossus. There is, indeed, fficulty in the supposition that Akhenaton imported Cretan painters corate his palace. The resemblances are too many and too close to cidental, and the style may well have originated in Crete. But no explanation can account for the treatment of the human figure at el-Amarna. Nothing like it is known in Crete, nor is there any other n art which may have influenced Akhenaton's sculptors. The whole de of this strange artistic innovation, which began and ended with eign of Akhenaton, remains a problem for archæologists.

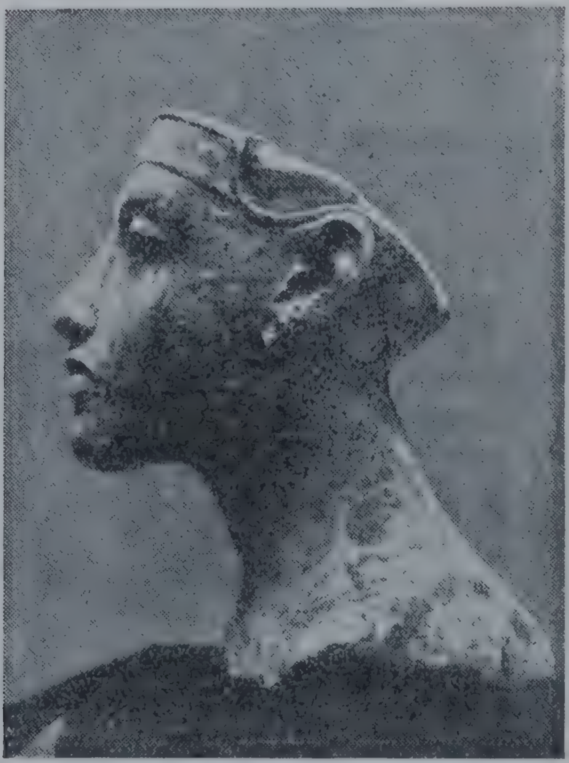

Fig. 25.—HEAD OF NEFERTYTI

It is difficult to speak in any general terms of the life and civilisat which lasted through many thousands of years. Many changes no do took place ; but the extraordinary conservatism of the Egyptians p served many customs almost unchanged from the earliest dynas down to the reign of the Ptolemies. Conditions must evidently h differed greatly in the different classes of the population, from the k and his officials and the priests at the one extreme to the serfs at other. Between the two were middle classes which varied considerably number and importance from time to time, according to the prospe and external relations of the kingdom. But all alike were affected by stereotyped routine which was necessitated by the geographical con tions. The very existence of Egypt depended on the dams and car which were necessary for the control of the Nile and its inundatio hence the institution of forced labour (corvée) which continued u modern times. Work on the land was dependent on the same cau During the inundation, from July to October, nothing could be done yond the watching and repair of the dykes. Then, in November, came time for sowing of all sorts of crops, and the people moved back on to land ; and the harvest followed in April. From the representations tombs, we can realise how the officials and other rich men themsel supervised the work that went on in their estates, with the help numerous scribes and other attendants. They must also have had la staffs of handicraftsmen and artists in their employ. Most of the arts handicrafts were hereditary, and this conduced greatly to the conser tism and traditional skill which characterise most Egyptian work.

The houses of rich men and officials were on the most lavish scale, included, in addition to living-rooms, courtyards, groves and gard and work-rooms and stores for all purposes. The houses of the mid and lower class were less magnificent, but similar in character, be usually built round a closed courtyard, with or without columns, w dwelling-rooms on the first floor, and flat roofs, with or without a canc made accessible by a staircase. These can be seen not only in painti but in terra-cotta models, supplied sometimes in the tombs of poc people, to provide them with accommodation similar to what they w used to in life.

Though all classes in Egypt, from the king to the serfs, appear to h been bound by an inexorable routine, the impression conveyed by pictures is not a gloomy one, but rather of a cheerful and busy outdoor life, full of industry and enjoyment. Relaxation and entertainme of various kinds seem to have been common. In the houses of the w to-do, visitors were received and feasts or banquets were provided which the company sat on the ground on mats. There were decorati of wreaths and flowers, and music and dancing followed. Such enterta ments can only have been given by the richer classes ; but picnics similar diversions were enjoyed by the common people, and festiv sacrifices, and other gatherings were widely attended ; an exampl offered by the great festival at Canopus, which in later times degenera into a wild sort of orgy.

The climate of Egypt, which suited such open-air life, was also s able for very light garments. These varied from time to time accord ie prevalent fashion. Men at all times often wore nothing but a kind oin-cloth or kilt, sometimes tightly folded or pleated. A vest might be ed, and a wide necklace was often worn. Women usually wore a single ght and narrow garment, falling nearly to the ankles. Nude figures etimes occur. But the drapery is often treated as if transparent, and artist shows a delight in the bodily forms which offers the greatest rast to the enveloping masses of clothing that conceal all but the ds and arms of Mesopotamian statues.

MESOPOTAMIA; UR

he recent achievements in archæology in Mesopotamia resemble in

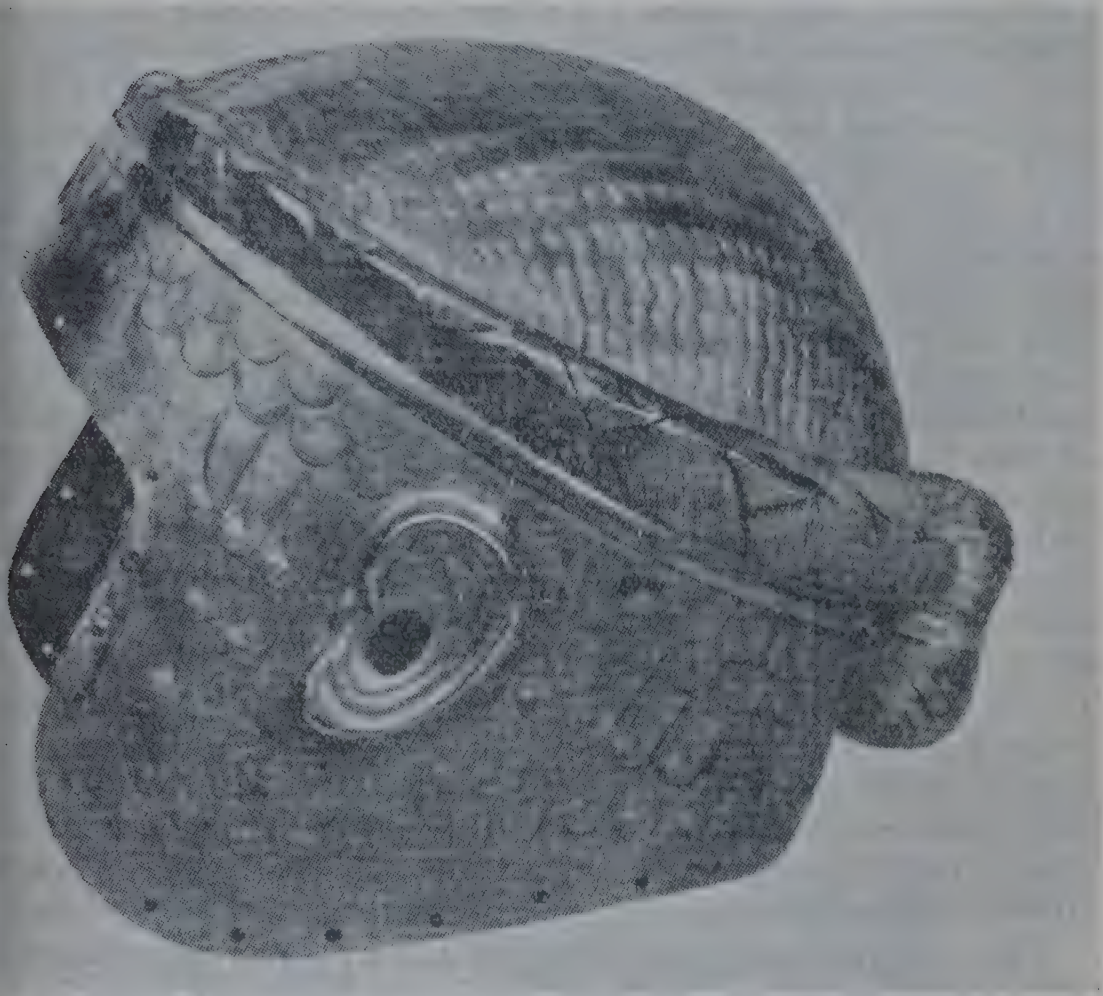

Fig. 26.—THE GOLDEN HELMET OF MES-KALAM-DUG

espect those in Egypt—they have carried back our knowledge many sands of years. The colossal winged bulls and extensive historical s of the Assyrian kings were among the most imposing acquisitions e last century; but they show for the most part a conventionalised in spite of their very spirited rendering of animals wild and tame. origin of this style may be now traced back to the early Sumerians, o cities and dynasties of a most remote age. The work of this period een discovered in recent years by explorers of various nationalities. most recent and in some ways the most astonishing finds are those r. Woolley at Ur. The town, with its streets and houses, is preserved great extent. The finest examples of handicraft come from the royal tombs, and are dated about 3500 B.C. But they show the highest skil design and technique, both in metal, mostly gold and silver, and in in work in various materials. Figures and heads of animals are beautif modelled. An excellent example is a gold helmet (*see Fig*. 26), closely ting the head and richly decorated. For inlay work, the most comp is the so-called " Standard of Ur." This represents, in shell and l lazuli, a series of scenes most delicately worked, representing the c of a campaign on one side, and a scene of peace on the other. O similar friezes show cattle, sheep and goats as well as warlike subje The men are usually represented, as they are in Sumerian sculpture, in loose woolly garments hanging in tufts and completely enveloping concealing the figure, in contrast to the clinging or transparent dres Egypt. In the royal tombs, a confirmation of the early date is, in Woolley's opinion, to be found in the custom of human sacrifice, of wh there is no trace in later Mesopotamia. In one of the royal tombs an ar bodyguard and many slaves and attendants, male and female, seem have been butchered where they stood in the approach to the to Among other finds are harps decorated with animal and other desi a wreath or head-dress of gold on a princess, weapons, implements vases, many of them of gold or silver. The whole impression produ is of a degree of wealth and of artistic skill that must, even at this e age, have had many centuries of growth and development behind it. most conspicuous building at Ur was the huge Ziggurat, a massive c of brick about 150 by 200 feet, and 75 feet high. Its walls, sloping slig inward and divided by projecting buttresses, give a great feelin stability ; and they already show the principles of design found in l Mesopotamian work. It also has huge staircases leading up to the terra The temples and palaces are very complicated structures ; but house the middle class are also found. These are built round a courtyard o to the sky, with a wooden balcony supported on columns of wood brick, and rooms opening out of it (*see Fig*. 27). The roofs were fla slightly sloped. On representations of towns there is often a tower at end ; a staircase led up to the living-rooms. The whole impression m by this early Sumerian civilisation is of magnificence in the case of rulers and great officials, and of comfort among the middle classes.

The Sumerian people are represented in art as of a rather squat fig with round heads and strangely projecting triangular noses, in str contrast to the Semitic people who later became predominant in M potamia. They usually are clean-shaven both as to hair and as to bea but some early princes wear long hair and beard treated in the ma familiar in Assyrian statues, which evidently follow after a long inte the same fashion. Circumstances do not allow the same vivid picture their life as we find in Egypt. They seem mostly to have lived in to with massive walls, for protection against enemies and floods. S dynasties are recorded as already existing before the great flood, of wh various traditions are preserved. Probably the common people, espec if occupied as herdsmen or agriculturalists, lived in temporary shelte the plain.

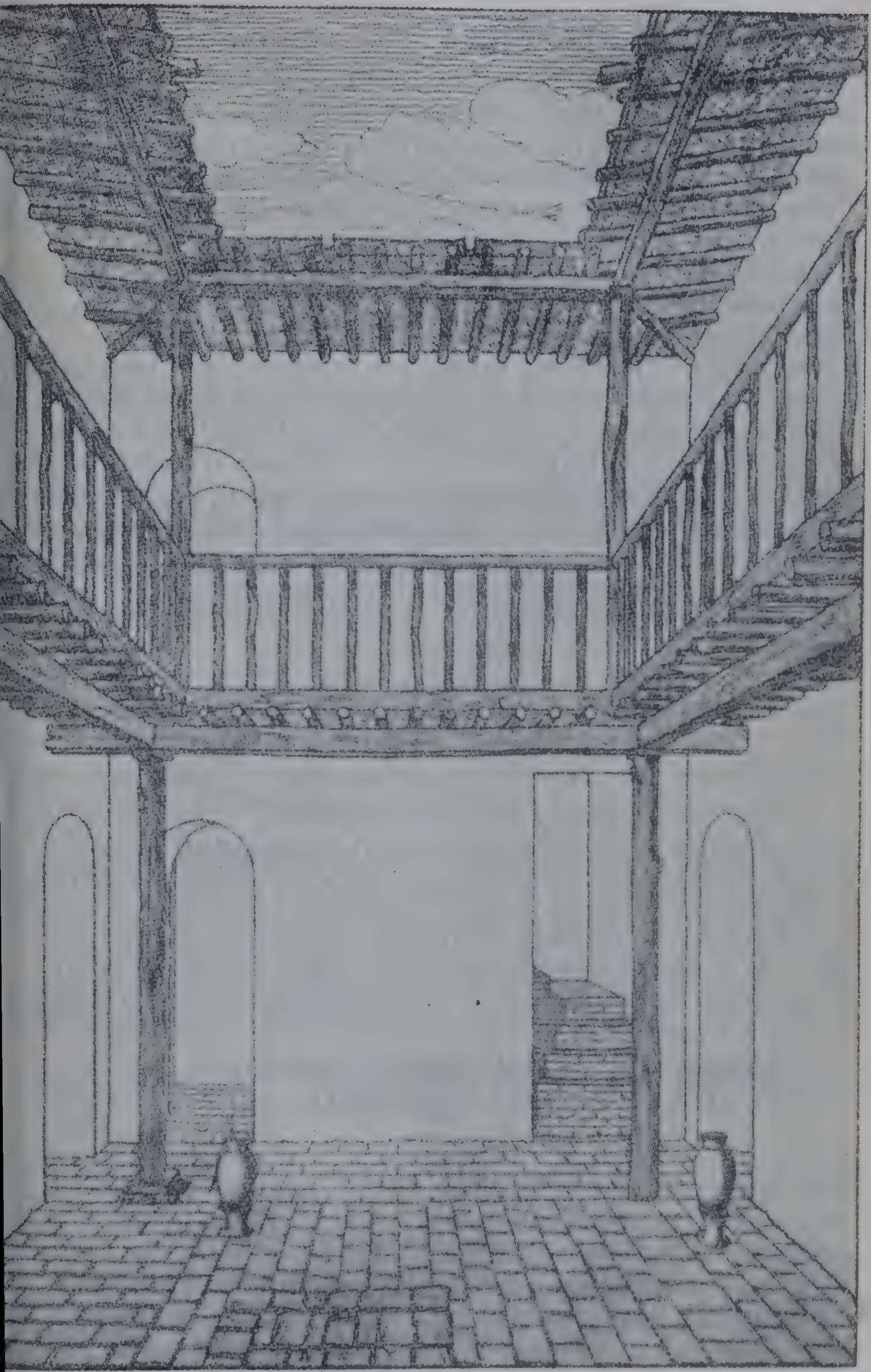

Fig. 27.—SUMERIAN HOUSE
After drawings by the late F. G. Newton

Exploration and excavation still continue, and there still appears t an ample scope for their activities. The most promising sites in Gr itself have been dug ; but there is still the project of the excavation of central part of Athens, at present occupied by part of the modern to Crete appears inexhaustible ; and many of the great and once flouris cities of Asia Minor still await their turn.

The excavation of Pompeii continues, and that of Herculaneum been resumed ; in Rome itself, and in its port town of Ostia, new important excavations are in progress.

Field work is still being carried out at many places in Great Brit mainly on Roman sites. A new auxiliary is now at the disposal of archæologist. Photographs taken from the air have given accurate sur of many regions hitherto inaccessible, and have revealed the sites even the plans of unknown towns. In many parts of England such ph graphs have shown roads and earthworks which are invisible to those walk over the site. In this, as in many other ways, archæology may c to be among the most progressive of studies.

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RECENT AND CONTEMPORARY PHILOSOPHY

By

A. WOLF

SYNOPSIS

differentiation of philosophy and science — The main depart-
ts of philosophy : ontology, epistemology, and axiology — The
f types of philosophy, and how to distinguish them.

ological Problems and Solutions : fluxionism and substantialism ;
tantival monism, dualism, and pluralism ; uniform and multi-
pluralism ; attributive monism, dualism, and pluralism ; absolute
lism, spiritual pluralism, materialism, energism, and neutral
ism ; tychism, necessitarianism, mechanism, vitalism, and
rgent evolution ; theism, deism, pantheism, and agnosticism ;
ralism and supernaturalism.

temological Problems and Solutions : gnosticism, scepticism,
nism, and pragmatism ; transcendentalism, idealism, theory of
esentative ideas, and realism ; empiricism, positivism, rationalism,
tionism, and mysticism.

logical Problems and Solutions : the nature and number of the
nate values ; their objective or subjective character.

general character of recent and contemporary philosophy, and
lassification of representative philosophers.

erialism, energism, and positivism in Germany — Absolute
ism in England, France, Italy, and the United States — Spiritual
lism in England and Russia — Neo-Transcendentalism (or neo-
ianism and phenomenology) in Germany — Biotism, vitalism,
matism, instrumentalism, and fictionism in France, Germany,
he United States — Realism, emergent evolution, and fluxionism
ngland, South Africa, and the United States.

spect — The present amicable relations between science, philo-
y, and theology, and some possible dangers.

RECENT AND CONTEMPORARY PHILOSOPHY

I. THE DIFFERENTIATION OF PHILOSOPHY

The original union of philosophy and science inevitably bec
loosened, in the course of the centuries, by the sheer accumulatio
knowledge. Imperceptibly a division of labour came increasingly
operation. Not only was philosophy differentiated from science,
science became differentiated into many sciences, and philosophy diffe
tiated into a number of philosophical studies. Nevertheless, until
nineteenth century some sort of pretence was kept up that Knowledge
one whole, and that the sciences were just specialised branches of ph
sophy. In the course of the nineteenth century however, not only was
pretence dropped, but there emerged something like a definite a
pathy between science and philosophy. This was largely due to som
the German idealists, whose extravagant incursions into the domai
science aroused the general resentment of men of science. Even in S
land, where everybody is reputed to be a philosopher, a scientist
Lord Kelvin did not veil his contempt for a philosopher like Ed
Caird, when both were teaching in Glasgow. This kind of host
gradually disappeared. Quite a number of scientists have actually tu
philosophers. And at the present time the incursions of men of sci
into the domain of philosophy threaten to become about as emba
sing as were the incursions of philosophers into the domain of sci
about a hundred years ago. At the moment, however, we are only
cerned with the differentiation of philosophy into a number of sepa
departments or branches. Something must be said about these in ord
make the study of recent and contemporary philosophy generally i
ligible.

Philosophy has three main departments, namely, (1) Ontology, or
study of the ultimate nature of being or reality, (2) Epistemology
theory of knowledge, or the study of the ultimate problems relating to
nature, validity, and limitations of human knowledge, and (3) Axiolog
the study of the ultimate nature, reality and significance of values (g
ness and beauty). Sometimes Ontology (1) and Epistemology (2)
grouped together as Metaphysics ; but sometimes the term Metaph
is used less correctly as synonymous with Ontology only, or with E
temology only. The two sub-departments of Axiology (3) are Ethic
Moral Philosophy, the study of the ultimate ideals and norms of cond
and Æsthetics or the Philosophy of Beauty, the study of the ulti
ideals and norms of art. There are also other departments of philoso
Of these, however, Logic as the study of the general conditions of
reasoning is really a preliminary to all other studies, including philoso

chology, the study of mental life, has recently established itself as an pendent science. Lastly, such studies as those designated the Philoy of Law, the Philosophy of the State, etc., are rather specialised ies arising out of certain ultimate problems of Law, Politics, etc., and nately connected with these special departments of research. The rtments of philosophy which are of most general interest are Ongy, Epistemology, and Axiology. And of these the first is of central est, the other two are mainly of interest in so far as they help to w light upon the first. In the following account attention will be paid fly to the ontological character of the philosophies dealt with, but the r aspects will also receive some consideration. Some philosophers, in-, have confined their attention to the problems of epistemology. Of only very few can be dealt with. And nothing at all can be said here t the numerous thinkers who are dealing with specialised philosophiproblems. Important as their work is, it cannot be presented in a ner sufficiently intelligible and interesting to the general reader. Nor possible to include in this survey all the particular varieties of is essentially the same world-view. Hence the inevitable omission of mber of well-known, and deservedly well-known, names in conorary philosophy. However, this account actually deals with some representative philosophers, and future historians of philosophy probably consider this a generous allowance for the period under w.

II. TYPES OF PHILOSOPHY

ere are many different types of philosophy, and the tendency to to all of them by means of a few names is rather misleading. No t there are some advantages in limiting the number of main distinc- between philosophical systems. But it is important to have some ciation not only of the principal cleavages between the various sophies, but also of the specific differences between philosophies n the same group. Perhaps the simplest way to make all the more rtant distinctions sufficiently clear is to indicate briefly the chief ems which philosophers have to face, and also the different ways in each of these problems has been answered in recent and contemy philosophy.

(a) *Ontological Problems and Solutions*

Perhaps the first philosophical question raised in the history of ern thought was this : Is there anything permanent at the basis of hanging phenomena of nature ? Many philosophers of all times ered the question in the affirmative, maintaining that there is some of " substance " underlying the flux of events ; others declined to any reality other than the flux of events as such. At the present largely under the influence of recent physical theory, a philosophy nts is perhaps accepted more widely than is a philosophy of sub-. The difference between the two views may be expressed by s of the terms *ontological fluxionism* and *ontological substantialism.*

(2) The second question may be stated thus : Is there only one ultim
reality, or are there two or more ultimate realities ? The possible answ
to this are obvious. Some hold that there is only one ultimate reali
some believe in two ultimate realities ; others admit a multiplicity
ultimate realities. These different views are known as *substantival mon*
substantival dualism, and *substantival pluralism* respectively. Of the th
the first and last are the most widespread.

(3) The third problem is this : Is ultimate reality all of one kind on
For those who accept *substantival monism* the answer is obviously in
affirmative. But for those who maintain a *substantival pluralism*
answer may or may not be in the affirmative. Some, for instance, beli
in a plurality of spirits which are all essentially the same in kind,
deny the reality of anything else. Others believe in a plurality of at
which are all essentially similar, and deny the ultimate reality of anyth
else. Either of these views may be described as *uniform pluralism*. Oth
again, believe in a plurality of different kinds of ultimate realities (bod
souls, etc.). This view may be described as *multiform pluralism*. Subst
tival monism, of course, is necessarily uniform.

(4) The fourth question is : How many fundamental (or irreduci
attributes does ultimate reality (or do the ultimate realities) possess ?
answer obviously may be, " One," or " More than one." The for
view may be called *attributive monism*, the latter *attributive pluralism*
the number of irreducible attributes is held to be two, then we may
the special name *attributive dualism*. Each of these distinctions natur
leads to other distinctions according to the irreducible attribute or
tributes ascribed to ultimate reality. If it is held that the sole attribut
of the nature of mind or consciousness, the view is called *idealism*
mentalism or *spiritualism* ; if the sole attribute is identified more esp
ally with thought, we get *panlogism* ; if it is identified with will, we
voluntarism. Idealists who accept substantival monism are called *abs*
idealists ; those who accept substantival pluralism are usually know
spiritual pluralists or *monadists*. The view which identifies the sole a
bute with matter is called *materialism* ; the view which identifies it
energy is called *energism* ; the view which identifies it with someth
different from mentality or materiality, though underlying both thes
called *neutralism* or *neutral monism*.

(5) The next ontological problem is : How are the various parts, u
or modes of reality interrelated ? One extreme view is that there are
real connections between things or events, that everything is a matte
chance. This view is known as *tychism*. Opposed to it is the view, kn
as *necessitarianism*, according to which law and order prevail throug
the universe, so that nothing really happens by mere chance. A spe
form of this view, and frequently but wrongly confused with it, is
view that everything happens in a way causally determined accordin
the laws of matter and motion. This view is variously described
mechanism, *determinism*, and *the mechanistic theory*. Midway between
two extremes of mechanism and tychism (yet presumably without fl
ing the various known and unknown types of orderliness maintained
necessitarianism) there are various views which aim at vindicating s
measure of spontaneity, novelty or originality for natural events,

dom for man. These views are known variously as *vitalism, creative*
ution, emergent evolution, and, more rarely, *libertarianism. Teleology*
e view which more especially seeks to vindicate the reality of purposes
urposiveness in natural events, as against the mechanistic view that
s causally pre-determined, or against certain idealistic views which
rd ultimate reality as a " block-universe " which is eternal and im-
able.

) Another ontological question amounts to this : Is there any being,
nything, that may be called divine ? One answer is to the effect that
lo not know. This view is known as *agnosticism*. The view which an-
:s the question definitely in the negative is called *atheism*, a term
er liberally applied according to taste, or want of taste. Of the af-
ative answers to the question the most familiar are those known as
m, deism, and *pantheism*, respectively. Theism is the belief in a per-
l God, who is the creator of nature and man, distinct from both, yet
nately connected with both. Deism and pantheism strive to avoid the
ropomorphic tendencies of theism, and insist that God is supra-
onal. Pantheism identifies God with the Universe, and thereby
eves a scientific economy.

) Lastly, there is this problem (more especially for those who recog-
the reality of a divine being) : Is the world of reality one intercon-
ed and orderly cosmic system, or is there a supernatural world, over
above nature, and capable of interfering with the order of nature ?
problem will probably be dismissed by agnostics and atheists as
ningless, inasmuch as they do not admit any other reality than nature.
ill also be dismissed by certain idealists on the ground that there is no
thing as physical nature, and by certain other idealists who are de-
ely atheistic. Theism and deism, however, would both admit *super-*
ralism, though deism would reject miraculous interferences with the
ral order of things. Pantheism definitely identifies nature or the
erse with God, and so rejects the supernatural. And some forms of
sm, while admitting the existence of deity in the universe, identify
with part of the universe, and reject the supernatural. Such a re-
on of a supernatural world, on the ground that the whole of reality is
orderly interconnected system, is known as *naturalism*. This term
ld not be confused, as it commonly is confused, with *materialism*.
naturalism leaves room for the mental, the spiritual, and the divine,
eas materialism (in the strict sense of the term) does not.

(*b*) *Epistemological Problems and Solutions*

The first question relating to so-called human knowledge is : Do
ave any real knowledge at all ? *Scepticism* is the view which throws
t on the possibility of real knowledge. (Epistemological scepticism
be distinguished from the limited scepticism and agnosticism which
doubt or deny the possibility of knowledge of ultimate reality, or
od.) *Fictionism* mainly differs from scepticism in maintaining that
mitations of human knowledge are not peculiar to man, but char-
ise also the knowledge of superhuman minds, if there are such.
natism likewise is not essentially different from scepticism. What it

says in effect is that the proper distinction is between fruitful beliefs misleading beliefs, rather than between true and false beliefs, but frui beliefs may be called true, and misleading beliefs may be describe false. Fictionism, as compared with pragmatism, admits rather m candidly that even avowedly false views may have practical importa and that it is just this practical importance that really matters. The that knowledge is possible may be described as *gnosticism*. This te however, is rarely used in philosophy. For gnosticism also has sev varieties according to the different answers given to the next questi and so the names usually employed are the specific names of these variet

(2) The second question, which of course does not concern the sev forms of scepticism, is this : How are the cognitive experiences, by wh we know objects, related to these objects, or *vice versa* how are the obj known related to the cognitions ? *Transcendentalism* maintains that s unknown materials are given to us but that the mind in the very ac apprehending them gives them certain forms, such as order in time space, causal connections, etc. (This view is also known as " criticism " critical idealism "). According to *ontological idealism* all objects mental in character, and their very existence is dependent upon s apprehending mind or knowing subject, though this need not be finite mind of man, but the Absolute, or " consciousness in gener According to the *theory of representative ideas* there are two kinds of jects, namely, psychical objects (or ideas), which depend on the mind are directly revealed to it, and physical objects, which are independen mind and are revealed to it only indirectly, or inferentially, thro mediating experiences. Lastly, according to *realism*, objects exist q independently of their being cognised, and are apprehended directl the mind, and as they are, more or less. Of these views, realism prob commands the largest following. There are, however, so many vari of realism that it is impossible to deal with them here.

(3) A third epistemological problem concerns the avenues of kn ledge. There are at least three such avenues commonly recognised, n or less. But there are great differences of emphasis ; some thinkers phasise one of these avenues, others another. *Empiricism* stresses se experience as the chief source of real knowledge. *Positivism* treats perience as the only source of knowledge, and is consequently oppose all metaphysical speculation. *Rationalism* emphasises the supreme portance of reason and of reasoning from, and according to, gen principles. *Intuitionism* attaches the greatest value to intuition, whic regarded as a more primitive form of apprehension, prompted largel feelings and instincts, and not yet so intellectual and abstract as tho and perception are. In recent philosophy intuitionism has come great prominence. Lastly, *mysticism* upholds the possibility of an i scribable spiritual vision of deity or of ultimate reality. It should be n that the supporters of one of the latter views often allow relative val to other powers of apprehension than the one to which they chiefly their faith. This is usually done by the recognition of different grade knowledge. In this way, a mystic may allow *some* value to intuition, rea and even sense-perception ; an intuitionist, to reason and sense-per tion, and so on.

(*c*) *Axiological Problems and Solutions*

Vhen we are interested in anything we attribute value (or worth) to it.
ngs are valued very differently, of course. Many things, perhaps most
gs, are valued only as a means to an end. But there are some things
are valued for their own sake. These may be called *ultimate values* ;
in philosophy we are mainly concerned with such ultimate values.

) The first axiological problem is : How many and what ultimate
es are there ? The usual answer is that there are three such ultimate
es, namely, Beauty, Goodness, and Truth. To these three a fourth is
etimes added, namely, Worshipfulness, or religious value. But most
kers are probably of opinion that religion is concerned with the con-
ation of the first three ultimate values mentioned above, rather than
the apprehension of any additional value. There are also other views
ch need not be discussed here.

) The second, and most important, axiological question (and the
other question that can be referred to here) is this : How are the
nate values related to reality ? Do they belong to things in the same
of objective way as the primary qualities do, or are they as subjective
econdary qualities were usually considered to be ? Some who regard
ndary qualities (colour, scent, taste, etc.) as subjective tend to think
values (or tertiary qualities, as they are often called) are also sub-
ve. According to this view, then, values are merely psychological
acters which are attributed to things in virtue of somebody's interest
hem, but have no reality apart from such interest or appreciation.
e hold that values are, at all events, independent of finite, individual
es. Others, admitting the objective reality of secondary qualities, have
ifficulty in admitting also the objective reality of values. Still others,
ed, regard values as of the very essence of reality, and speak confi-
ly of a kind of mystic experience (intuition or vision) in which reality
value are apprehended as one. Lastly, there are various differences of
ion as to which of the above-mentioned ultimate values are objective.
e have no difficulty in regarding beauty as an objective quality of a
tiful landscape, or in regarding goodness as an objective quality of a
action or a good character, but cannot attribute truth to anything
propositions. Others find it easier to accept the objectivity of Truth
of Beauty or of Goodness. And so on. In the main, however, it may
aid that the present tendency is to treat ultimate values as objective
er than as subjective, although there are different views as to the
ise sense in which their objectivity should be interpreted.

(*d*) *The Characterisation of Types of Philosophy*

his brief review of philosophical problems and their solutions may
ce to show that no philosophy can be adequately described by means
ny single " ism," like " monism," " idealism," " realism," etc. A
iderable number of " isms " would be required in order to charac-
correctly any one system of philosophy. And an exhaustive classifi-
n of the possible combinations of the various " isms " would be a
complex affair. Any such attempt, moreover, would be hampered
by the fact that the antitheses between different views have lost a

good deal of their sharpness, in recent years, owing to an increas mutual understanding and a consequent " meeting of extremes," wh makes it necessary to take into account differences of shade and of phasis as well as the more palpable differences. Then, too, there is, in last resort, something individual and personal about each philosophy, this complicates still further any attempt at an accurate classificat Yet, for the purpose of an easy survey, any grouping is better than no and there are certain advantages in a simple grouping, provided it is misunderstood. We propose, therefore, to arrange the selected rep sentatives of recent and contemporary philosophy in a few rather lo groups, trusting that the foregoing summary review of the main pr lems of philosophy and their solutions will enable the reader to put e philosopher in his proper place in the general philosophic scheme, if h desire.

III. GENERAL CHARACTER OF RECENT AND CONTEMPORA PHILOSOPHY

(*a*) The period with which we are concerned is a period of about ha century, beginning approximately at the point where the " Retrospe (see the first Article in this volume) ends, and terminating early in 1 The middle decades of the nineteenth century showed a marked dency towards materialism and empiricism. This tendency gave rise the one hand, to a certain amount of philosophy which was more or materialistic, or energistic, or at least positivist; but, on the other h it also stimulated, by way of reaction, a strong interest in idealistic ph sophy. Idealistic philosophy had had a golden age during the fifty year so following the publication of Kant's *Critique of Pure Reason* (1781), its traditions had been kept alive by at least a few distinguished phil phers. It was therefore comparatively easy to take up, and to develop, idealistic philosophy in its various forms. The greatest service in connection was rendered probably by T. H. Green, who developed views, just as Kant had developed his, largely in opposition to the em cism and scepticism of Hume. Of the several forms of idealism which been taught during the period under review two at least may be rea distinguished, namely, absolute idealism (which tends to be pantheis and monadism or spiritual pluralism (which is usually, though not alw theistic).

In Germany, the revived interest in idealism produced a philoso movement the aim of which was to begin all over again the work of t scendental criticism initiated by Kant. This movement began with slogan, " Back to Kant," but eventually, although it tried to be even m radical than Kant, it ended by being far more speculative, and perh less critical, than he had been. Of this movement, which may be ca Neo-Transcendentalism, or critical idealism, there are at least t branches, namely, one led by H. Cohen, another by W. Windelband, a third by E. Husserl. The first two of these are commonly know Neo-Kantianism, the third as Phenomenology.

Idealism has taken firm root not only in England and Germany also in France, Italy, and the United States of America.

ı France the reaction against materialism assumed yet another form ı that of idealism, though intimately connected with it historically. Bergson, namely, has expounded a philosophy according to which nate reality is Life (rather than the " matter " of materialists or the ought " or " consciousness " of idealists). For want of a better word philosophy may be named " biotism." The concept of evolution rally has an important place in biotism. In Germany and elsewhere a ewhat similar reaction to materialism has shown itself in the much e restricted view known as " vitalism," the view namely that living nisms cannot be explained without assuming a principle of life (or principle) as dominating the physical organism. Various theories of vledge have also been influenced by " biotism." This applies notably ertain epistemological theories already mentioned, namely, pragsm, instrumentalism, and fictionism, all which treat beliefs as instruts of life, and to be valued accordingly.

hile idealism may be said to have succeeded very well in its opposition aterialism, and as a reaction against this, it has also managed to pro- a reaction against itself. Some thinkers, while agreeing that it is imible to derive mind from matter, find it equally difficult to derive er from mind, or to regard matter as in some sense an external arance of mind. In recent years this reaction against idealism has ı based mainly on epistemological considerations. The anti-idealistic is known as realism, of which there are various kinds. But they are t of them agreed in maintaining the reality of something besides d (or consciousness) and independently of it. Some realists have loped a more or less complete system of philosophy, while others so far confined their attention to the epistemological problems. For most part realists are also naturalistic, and some of them find room leity within the universe.

ne of the most characteristic features of recent philosophy is due to influence of the new physics. The tendency of recent physicists to rd matter as composed, in the last resort, of electric charges or waves nduced some philosophers, especially the realists, to conceive reality uxional rather than as substantival, that is to say, as consisting of a of events rather than of permanent substances. This view, which lready been described as fluxionism, has probably had a good deal to ith the abandonment of naturalism on the part of many contemporary tists, and their almost embarrassing anxiety to subscribe to idealism. e appear to be acquainted only with the following short catechism :

Q.—What is mind ?	A.—No matter.
Q.—What is matter ?	A.—Never mind.

culties in the conception of matter, however, are a poor reason for ifying it with mind. Some try to get over the difficulty by positing third kind of entity which is neither mind nor matter but from h both have emerged. This " neutral stuff " is sometimes called nd-stuff," apparently because it is neither " mind " nor " stuff," gh it gives rise to both.

other characteristic feature of recent philosophy is the emphasis

placed upon emergent evolution. This is especially true of biotism,
which life and its creative evolution are almost everything. But it is a
true of realism. This is due partly to the tendency of realism to b
itself as far as possible on the broad results of science, biological as well
physical ; and evolution is, of course, one of the basic theories of mod
biology. And partly this is due to the tendency of realism towards na
ralism, and the help which the concept of emergent evolution affords
the attempt to include all realities in the one universe.

(*b*) In accordance with the foregoing sketch of the main tendencies
recent and contemporary philosophy we propose to arrange the follow
accounts of some forty representative philosophers of the period un
the following headings :—(1) materialism, energism, and positivis
(2) absolute idealism ; (3) monadism or spiritual pluralism ; (4) n
transcendentalism (or neo-Kantianism and phenomenology) ; (5) biotis
vitalism, pragmatism, instrumentalism, and fictionism ; (6) realis
emergent evolution, and fluxionism. The general significance of th
terms has already been explained in the preceding pages.

The selection of representative philosophers is always a difficult mat
for a contemporary, especially when there is an *embarras de riches*
Many fishes as good have been left in the sea. Moreover, the differ
countries have been treated very unevenly, and their philosophical me
must not be judged by the number of their representatives included
the following sketches. The selection of representative philosophers
been determined mainly by the desire to have every important philo
phical tendency adequately represented, and to have them represented
far as possible, by philosophers in whom English and American reader
general education are likely to be most interested. To these considerati
must probably be added another factor, namely, the writer's convenie
and limitations.

IV. MATERIALISM, ENERGISM AND POSITIVISM IN GERMA

E. H. Haeckel (1834–1919) was probably the most influential advoc
of Darwinism. In his hands Evolutionism became a whole system
philosophy instead of a purely biological theory. Of the biological id
associated with his name the most familiar (though he did not origin
them entirely) are those of phylogeny and recapitulation. Phylogeny is
study of the evolution of the various species of plants and animals. It le
to the construction of genealogical trees, the lower parts of which rep
sent the ancestral types, while the branches represent various desc
dants, and the twigs represent the latest offspring. In his *Descent of M*
Darwin had already sketched one such tree. Haeckel and his follow
attempted many such genealogical trees. The principle followed
briefly this. First of all it was determined by comparison what animals h
a similar form or plan. For example, the amœba and infusorians are al
in being unicellular. Next, we note which of them is the less differ
tiated. This is regarded as the ancestor, or as the type nearest to
ancestral form of that group. Thus, for instance, the amœba has
definite organs, whereas the infusorians have certain specialised str
tures. The amœba was, accordingly, regarded as the ancestor, and

sorians as a branch. The other theory, namely, the Recapitulation eory, states that during its development, from the egg to its final n, every animal repeats the stages in the evolution of its species n its unicellular ancestor. The pace of embryonic development is, course, enormously faster than that of the racial evolution. In the rse of a few days, or even a few hours, an embryo may pass through mber of stages which may have taken millions of years in the racial ution.

ccording to Haeckel the simplest conceivable animals, the so-called *eras*, crystallised from lifeless matter. And he conceived of the whole nic process as a continuous evolution, from the simplest atoms to the est forms of being, in accordance with strictly deterministic laws. re is no fundamental difference between living and lifeless bodies, ifeless crystals have definite structures whereas some living organisms none. Moreover the elements found in organic matter are also found organic matter, and it is possible to produce some organic compounds icially. All things, then, are composed of the same kinds of elements, are dominated by the same forces of attraction and repulsion be- en their atoms. Even the so-called soul is only a number of extremely plex reactions of the central nervous system. The simplest living gs arose by spontaneous generation, and from these all higher forms fe have evolved under Natural Selection. A molecule more or less of on or phosphorus or sulphur may have been the sole difference be- en the primitive forms of life which formed the several ancestors of he many forms which have evolved from them. Haeckel stressed the *istic* character of his world-view, inasmuch as he held that matter nposed of atoms) is the only ultimate reality, and that all things, living ell as lifeless, conscious as well as unconscious, have evolved from it rding to iron laws. His monism, in fact, looks very like materialism. that is not altogether true. For he endowed even his atoms with s, so that matter, as Haeckel conceived it, was not the lifeless matter horoughgoing materialists. Haeckel was a hylozoist rather than a rialist. And Haeckel's philosophy, if it was monistic as regards the ultimate substance which he recognised, was also dualistic in regard e two attributes (materiality and mentality) with which he credited orce was regarded by Haeckel as an aspect of matter.

ürliche Schöpfungsgeschichte, 1868 (Eng. Tr. *The History of Creation*, ondon, 1883);
ropogenie, 1874 (Eng. Tr. *The Evolution of Man*, London, 1879);
Welträtsel, 1899 (Eng. Tr. *The Riddle of the Universe*, London, 1902).]

. *Ostwald* (b. 1853) has formulated a philosophy of “ energetics,” rding to which ultimate reality is energy. Energy is capacity for work, hat results from work, or what is converted into work. All the pro- es of matter can be expressed as various forms of energy. Its mass be expressed in terms of work and velocity. Its volume can be ex- ed in terms of compressibility. Its shape can be expressed in terms sticity. And matter is just the synthesis of such energies. Heat, light, d, magnetism and electricity are all of them kinds of energy. All

chemical properties are forms of energy which operate in the tra
formation of substances. Bodies are comparatively stable collocations
various energies in approximate equilibrium. Living organisms are s
tionary bodies having free chemical energy to render metabolism, nu
tion, and reproduction possible. “ The entire mechanism of life can
compared to a water-wheel. The free energy corresponds to the wat
which must flow in one direction through the wheel in order to prov
it with the necessary amount of work. The chemical elements of
organisms correspond to the wheel, which constantly turns in a circle
it transfers the energy of the falling water to the individual parts of
machine.” Consciousness likewise is some kind of energy. Ostw
speaks of soul-energy as well as nerve-energy. “ We know that men
work is connected with an expenditure of energy and exhaustion, j
as physical work is.” Ostwald repudiates the charge of materialis
seeing that he rejects the ultimate reality of matter altogether. He
also protested against the common assumption that he meant to red
life and consciousness to merely physical energy. His view is rat
that while so-called physical energy must be regarded as the basis of
things, including life and consciousness, yet some sort of auxili
concepts are required to account for the appearance of life and of c
sciousness. What he has in mind is the kind of concepts after wh
vitalism and emergent evolution are feeling their way, though he d
not accept vitalism as such. With regard to his reduction of matter
energy, Ostwald claims in his favour the whole tendency of rec
physics to reduce atoms to electric charges.

[*Die Überwindung des wissenschaftlichen Materialismus*, 1895 ;
Naturphilosophie, 1902 (Eng. Tr. *Natural Philosophy*, London, 191
Die Philosophie der Werte, 1913.]

E. Mach (1838–1916) maintained that the physical and mental scier
should apply the same scientific methods, inasmuch as the subject-ma
with which they are concerned is reducible to common terms. Follow
out the line of argument used by Hume, Mach argued that physical
psychical phenomena can be resolved into common elements. For,
identifying physical objects with their sensible appearances, M
thought that he abolished the alleged intrinsic differences betw
physical and psychical phenomena. The only difference between th
according to Mach, consists in their external relationship to other phe
mena. The phenomenon of colour, for instance, is physical in relatio
its luminous source ; it is psychical in relation to the experience of sens
it ; but in itself it is neither physical nor psychical. The relationshi
question is what is commonly known as dependence, and is determi
usually either by the method of difference or by the method of conco
tant variations, the successful application of which establishes a fu
tional relationship between various contents of experience. The main
of science is to discover such functional relations between phenom
Such discoveries, when crystallised in ideas and theories, serve an eco
mic purpose, inasmuch as they summarise past experiences and antici
future experiences. That, in fact, is the motive which prompts our sea

such ideas and theories. It is the felt need of finding our way in nature : necessitates the discovery of such concise directions for the conduct ife. The tendency of science to replace qualitative by quantitative ounts of phenomena is due to the greater simplicity and comprehen-:ness (that is, economy) of quantitative summaries. Ultimate reality, ording to Mach, is almost what is now commonly called " neutral f," and Mach's philosophy was substantially monistic. But he was licit in his rejection of materialism. Bodies were for him only thought-bols of complex experiences. And the extensive use of " mechanistic " des of explanation he regarded as due to our greater familiarity with n, and to the tendency to employ analogies in order to simplify ex-ation. Even what is explained mechanistically must, therefore, not egarded as though it were merely mechanical or material. His con-tion of the rôle of science, and of knowledge generally, was influenced the theory of evolution and its emphasis on the need of a growing ptation of life to environment in order to ensure survival.

: *Mechanik in ihrer Entwicklung*, 1883 (Eng. Tr. *The Science of Iechanics*, London and New York, 1893);
räge zur Analyse der Empfindungen, 1886 (Eng. Tr. *The Analysis of ensations*, London and New York, 1906);
enntnis und Irrtum, 1905.]

V. ABSOLUTE IDEALISM IN ENGLAND, FRANCE, ITALY, AND THE UNITED STATES

. H. Green (1836–1882) was the leader of the English idealist reaction nst empiricism and evolutionism. Negatively his philosophy was npted by his aversion for what used to be regarded as typically British osophy. Positively it was influenced by German idealism, and is con-iently described sometimes as Neo-Kantianism or Neo-Hegelianism. hostility to empiricism (as taught by Hume and his followers) and to utionism (as taught by H. Spencer and others) was inspired, in the instance, by moral considerations. He felt that when man is con-ed to be a " being who is simply the result of natural forces," his acter is misunderstood and his life is degraded. Such a conception, rding to Green, utterly fails to account for man's sense of moral gation, involves a denial of human personality and of the very pos-ity of all the higher intellectual and moral activities of man. Green rdingly set out to show the true nature of man, his real potentialities, his relation to merely natural phenomena.

ı order to understand the real nature of man it is necessary first of all nderstand the nature of our consciousness, the reality of which is all we are sure of, to begin with. Now human consciousness, according ireen, is essentially self-consciousness. In the case of man even the plest process of sense-perception is not a mere change, but the con-isness of a change. All human experiences, in short, consist not of : events, physical or mental, but of *recognitions* of such events. What ipprehend, therefore, is never a *bare* fact, but a *recognised* fact, a hesis of relations in a consciousness which involves a *self* as well as the elements of the objects apprehended, which it holds together in t unity of the act of perception. Thus knowledge always implies the wo of the mind or self. This work of the mind, however, is not capricious arbitrary. This is attested both by the common distinction between tru and error, between reality and illusion, and by the very existence of t sciences. But all this, according to Green, implies that the reality wh we know is an intelligible reality, an ideal system, in short, a spirit world. And such a world can only be explained by reference to a spirit “principle which renders all relations possible and is itself determin by none of them,” an absolute and eternal self-consciousness which a prehends as a whole what man only knows in part. This “principle,” t absolute and eternal self-consciousness, is God. In some measure m partakes of the self-consciousness of God. This participation is the sou of morality and religion. It is also the justification of the belief in imm tality. For a self-conscious personality cannot be supposed to pass aw but must partake of the nature of the eternal.

Turning to the moral life of man, Green maintains that reflection reve to man certain capacities and corresponding responsibilities, in the ercise of which man finds his highest good. This good consists in realisation of personal character, the realisation of the highest self. In far as the motive which prompts one to realise one’s true or highest s lies in man himself, the determination so to realise one’s self is a s determination. And such self-determination to realise his true good c stitutes the freedom of man. But individual self-realisation is possible o in society. Just as there can be no society without individual persons there can be no fully developed persons without a society in which individual persons, while retaining each his own individuality, are a integrated so as to form a social whole, in which each develops his spe aptitudes. It is only in such a society that the highest moral good can realised.

[*Prolegomena to Ethics*, Oxford, 1883 ; *Works* in 3 vols., London, 188

F. H. Bradley (1846–1924) attempted to construct an idealist ph sophy free from that intellectual bias which characterised Green’s ideali Of the moderns, it was Hegel who had first identified the “real” w the rational, and Green had adopted the same view. Bradley, howe found this kind of idealism “as cold and ghostlike as the dreariest m terialism.” The apparent glory of the perceived world is just as much deception and a cheat” if it hides some “spectral woof of impalpa abstractions, or unearthly ballet of bloodless categories” (which He lian idealism regarded as ultimate reality) as if it hides “some colour movement of atoms” (which materialism treated as ultimate reali Apparently the nature of consciousness, which Green had made the sta ing-point of his philosophy, had not been fully appreciated by h Bradley, accordingly, made a fresh start.

For Bradley the starting-point is “immediate experience” rather t cognitive consciousness. In immediate experience we have “an immedi feeling, a knowing and being in one.” It is at first an undifferentia unity, and non-relational, but it contains implicitly numerous distincti ch discursive thought or judgment makes explicit. For immediate erience is felt to be inadequate, and thought is our endeavour to supnent it by introducing distinctions, abstractions, qualifications, and tions, etc. But the categories and concepts with which thought rates, though useful as working ideas for the special tasks of science, unsatisfactory for a philosophic understanding of ultimate reality. he Nature studied by the observer and by the poet and painter, is in ts sensible and emotional fulness a very real Nature. It is in most ects more real than the strict object of physical science." For the cons of science are abstract and not ultimately true. Space and time, rela and quality, primary and secondary qualities, motion and change, sation and activity, self and things-in-themselves—all these notions n closely examined end in self-contradiction, and are therefore apable only to mere "appearances," not to ultimate reality. For ultie reality must be self-consistent and harmonious. Yet even "appeares" cannot be mere illusions, though Bradley sometimes described n as such. They must have a place in ultimate reality. How is ultimate ity, the Absolute, to be conceived? The clue to such a conception, ugh a very inadequate conception, is sought by Bradley in immediate erience, at least in immediate experience at a higher remove. The olute is a Spirit embracing and completing all finite experiences and pearances." And the experience of the Absolute, or the absolute exence, repeats at a higher remove, with infinitely greater wealth and ection, the "immediate feeling," the "knowing and being in one" ch characterises the "immediate experience" of human beings. eality is one experience," and "experience" exhausts all reality. here is no being or fact outside of that which is commonly called hical existence. Feeling, thought and volition (any groups under ch we class psychical phenomena) are all the material of existence. there is no other material actual or even possible." "Spirit is the y of the manifold in which the externality of the manifold has utterly ed." "Outside of spirit there is not, and there cannot be, any reality, the more that anything is spiritual, so much the more is it veritably "

nlike Green, who believed in the *personality* of God, Bradley regarded Absolute as supra-personal. He also rejected the attribution of "good-" to God. And he denied the view (of Kant and Green) that personal ortality is an implication or postulate of the moral life. But, in agreet with Green, Bradley denied evolution of the Absolute. The Abso- "has no history of its own, though it contains histories without ber."

ical Studies, Oxford 1876, 2nd ed., 1927;
Principles of Logic, London, 1883, 2nd ed., Oxford, 1922;
earance and Reality, London, 1893, 8th ed., 1929;
ys on Truth and Reality, Oxford, 1914.]

Bosanquet (1848–1923) is perhaps chiefly noteworthy in the history ritish Idealism for his defence of thought as a pathway to absolute y. Bradley had made much of the alleged inconsistencies to which thought leads by its abstractions. Bosanquet maintained that it was a m conception of the real nature of thought to identify it with the formati of abstract universals, which naturally led to an inadequate interpre tion of reality. Thought at its best is systemic, not merely abstract. helps us to construe the systematic character of reality. Its characteris " universal " for the understanding of reality is the " concrete universa that is, the conception of a " whole " or " system," not the merely " a stract " universal which is only concerned with what is common or ge eral in things, instead of with their systemic interrelations in a whole system. So conceived, thought leads, not to contradiction or illusory a pearance, but to the very heart of reality. In fact it is " the self-revelati of reality." Thought and reality are correlative. " Thought . . . is alw an affirmation about reality." And reality " is the whole that though always endeavouring to affirm." The common opposition of thought logic) to feeling struck Bosanquet as the silliest of all silly superficialit " The emotional absorbing or carrying power which belongs to gr ideas, great characters, great works of art, is measured by the depth a spread of their roots and sources in reality ; and this again is measured their logical power, their power to develop and sustain coherence with whole." In all experience the influence of " the whole," or the concr universal, is implicit. But in logical thought, which follows the natu impulse to seek truth and reality, we have " the whole " operating plicitly as the criterion. In it " the idea of system, the spirit of the co crete universal, in other words, of individuality, is the central essenc All higher human experiences are characterised by the fact that in th comes to light the coherence of things, the " wholeness," or syster integrity, of the universe, that is, the Absolute. In such experiences, cordingly, we feel " the heart-beat of the Absolute." And the Absol is the final synthesis of mind and nature. Nature and mind are correlati Nature is what is revealed to mind ; and mind is what apprehends or terprets nature. In the Absolute all finite experiences are transmuted a perfected into a complete whole. As such a Whole in which everythin adjusted in relation to the rest, the Absolute may be described as tel logical or self-directing.

[*Knowledge and Reality*, London, 1885 ;
Logic, Oxford, 1888, 2nd edn. 1911 ;
Principle of Individuality and Value, London, 1912 ;
Value and Destiny of the Individual, London, 1913 ;
Implication and Linear Inference, London, 1920 ;
Meeting of Extremes in Contemporary Philosophy, London, 1921.]

Viscount Haldane (1857-1928) was essentially a follower of Hegelian Absolute Idealism, though he did not like the term idealism. Experie is the only possible point of departure. But experience always disclo as immanent in it, and as its foundation, an ideal system wider in ra and in quality than itself. This ideal system Haldane calls " Knowledg But this " knowledge " must not be regarded as merely an object of experience, or as an activity which merely establishes external relation independent objects to the mind. The character of an object is ne ependent of the character and activity of knowledge. For being always)lies meaning of a certain kind ; to be meaningless is to be beingless. ere are many different levels of knowledge varying with the extent to ch abstraction is made from the wealth of detail in the facts observed ; each level of knowledge has for its object a corresponding level of ity. Physics, Biology, and Psychology, for instance, involve diminng degrees of abstraction, and accordingly represent different levels nowledge and reality. But all levels of knowledge and reality have r places and mutual relations in the entire system of Knowledge. The h is the whole, but the limitations of finite minds, and their habit of inguishing subject from object, prevent them from grasping the whole y. Perfect knowledge must, however, be conceived as self-complete all-inclusive. In it the isolation of subject from object, and the anesis of universal and particular, are overcome. Unlike human experie, all that is distinguished in it falls within it, so that it is more than ely relational ; it is an absolute system of self-knowledge. The contion of such ideal knowledge and of its immanence in human experie seems necessary for the understanding of the Universe. Knowledge rpreted in this wide sense, and with its ideal completion taken into ount, is not only the foundation of reality, but is indistinguishable it. In other words, Knowledge is not merely one kind of event ng others ; it is the universe which embraces all events.

e Pathway to Reality, London, 1903 ;
Reign of Relativity, London, 1921 ;
Philosophy of Humanism, London, 1922.]

. *Ravaisson-Mollien* (1813-1900) helped to revive and develop the osophy of spiritual activity initiated in France by Maine de Biran 6-1824), but long neglected. According to Ravaisson, nature is esially spirit or spiritual activity. Spiritual activity is not merely a tion or attribute of reality, but reality itself—to act is to be, and to be act. Thought is such a spiritual activity, for volition and thought are and the same activity. The aim of thought is the unification of exence. And knowledge is essentially like art, since knowledge is the luct of the creative synthesis of thought. Knowledge of reality is imible without the aid of spiritual categories. The biological sciences, as ernard (1813-1878) had shown, had to explain the parts of organisms eference to the whole, and could not dispense with teleological exation. But the physical sciences are not essentially different in this ect, since inorganic or inanimate phenomena differ only in degree, n kind, from those of life and consciousness. The inertia characteristic animate objects is a kind of habit, or a degeneration of will, and only ts are capable of forming habits. Physical nature is a by-product of , a " dispersion " of the divine spirit. God is the supreme principle of r and harmony in the world. He created matter, with all its imperfec-, in order that life may re-awaken out of it and so recover its perfec- Progress presupposes a fall.

port sur la Philosophie en France au XIX Siècle, 1867 (5th edn. 1904) ;
'Habitude, 1894.]

C. Renouvier (1815–1903) attempted a fusion of positivism and idealis
on a basis of phenomenalism. Phenomena, he insisted, are the on
things directly known. They are our data. Now phenomena have tv
aspects. They appear *to* us, and they are appearances *of* something. It
a mistake to divorce either of these two aspects from the other. That is
say, it is a mistake to treat phenomena as if they were objects independe
of all experience, independent of their appearance *to* somebody—this
the realistic mistake; and it is a mistake to treat phenomena as if th
were just experiences without any objective reference, as if they were n
appearances *of* something—this is the idealist's mistake. Phenome
must be regarded in their integrity, in their dual aspect. And regarded
this way they constitute reality, so that we can dispense with a thing-i
itself and with an independent subject beyond the experiences of t
phenomena. This does not reduce the world to the mere play of subje
tive caprice, for phenomena have their laws, or uniform mutual relatio
which give them order and permanence. In the first place, they all ha
certain ultimate laws or categories, namely, Relation, Number, Exte
Duration, Quality, Becoming, Causality, Teleology, and Personality.
the second place, they are subject to the various particular laws d
covered by the several sciences. In his later writings, however, he a
mitted also the existence of more organic individualities than orde
aggregates of phenomena, namely, Leibnizian monads, spiritual indi
dualities, and personalities. " When freedom makes its appearance i
given being, that being, bound by a thousand relations to other bein
acquires an incomparably more individual existence : what was only d
tinguished is now separated ; what was a self becomes self-subsistent,
essence, or . . . a substance . . . ; an individual, and the most individu
individual that is known—the human individual, the human person."

Moreover, in order to form a comprehensive view of reality as a who
more is needed than a knowledge of the categories and particular la
We must assume the principle of contradiction, and we must resort to
principle of free Belief under the inspiration of our whole personali
Renouvier believed in a kind of harmony between man and the universe
virtue of which the universe responds to the moral demands of man.

In some ways it would be better to class Renouvier's philosophy w
critical idealism, or even with monadism, rather than with absol
idealism. On the whole, however, in a brief outline like this, it is bet
not to separate him from the other French idealists included here, name
Ravaisson and Lachelier.

[*Essais de Critique générale*, 1854–1869, 2nd ed., 1875–1886 ;
La Nouvelle Monadologie, 1899 ;
Les Dilemmes de la Métaphysique pure, 1901 ;
Le Personalisme, 1903.]

J. Lachelier (1832–1918) set out from the critical philosophy of Ka
According to this philosophy the world of experience, as science int
prets it, derives its orderliness or organisation from the forms and ca
gories with which the mind apprehends and interprets it. And the natu
laws discovered by science owe their universal validity to the fact t

y must conform to the constitution of the mind, inasmuch as they are oducts of the mind. Whereas, however, Kant had assumed that the nd only applied certain forms and categories to certain sense-data, or materials, independent of it, Lachelier maintained that mind actually ates the whole world of experience, and that there are no independent a to which it must adapt itself. In other words, according to Lachelier, nd or thought is the only ultimate reality. The world of sense-percep- n, it is true, appears to everybody to be independent of perception. t this is only so because that world is the object of an intelligent con- ousness, which gives it objectivity by making it an object of thought, l thereby saves it from the mere subjectivity of sense-consciousness. s just by organising them into a system of truths that thought gives ectivity to physical and mental phenomena and saves them from jective relativity. And the reality of thought is demonstrated by the stence of a world which only thought can explain. The existence of sen- lity shows that thought is something more than pure intellect. For it is an act of will that thought gives a sense-content to space and time. chelier, in fact, distinguished three levels of thought. On the first level, ught is intellectual and abstract and treats things as subject to mechani- causality. On the second level, thought has particulars for its objects, ch it posits by an act of will, and externalises in space. These objects pictorial and determined teleologically. On the third level, thought is -conscious, and attains its freedom. Lachelier associated these three els with science, art, and religion respectively. The three levels, or des, were not intended by him to represent three successive stages in e, but rather as co-existing phases. " Being is not first a blind neces- , then a will which must always be restrained by that necessity, and lly a freedom which must recognise the existence of both. It is free- n through and through, in so far as it is produced by itself ; it is will ough and through, in so far as it is something concrete and real ; it is essity through and through, in so far as it is intelligent and gives an ount of itself." Lachelier identified God with universal Thought ; and gion with the individual's sense of dependence on universal Thought.

Fondament de l'Induction, 1871 ;
chologie et Métaphysique (in the *Rev. de Métaph. et de Morale*), 1885.
n in one volume in 1896.]

. *Croce* (b. 1866) is the leading idealist philosopher of contemporary y. His " philosophy of the spirit " sets out from the Augustinian and tesian view that conscious experience is what we are most sure of ; and naintains, after the manner of the German idealists, that it is the only of reality that need be assumed. Spiritual reality, however, contains e than the experiences of merely finite minds. Like the absolute lists, Croce posits also a universal consciousness or Spirit which is nanent in all finite minds and is more than the mere totality of finite ds. But whereas Hegel and his followers conceived of the dialectic of ersal thought as essentially logical rather than temporal in character ugh Hegel could not avoid conveying the impression that it was also a ess in time), Croce definitely regards the cosmic spirit as a process in

time, and identifies reality (or philosophy, for the two are necessarily
same in such a spiritual system) with history. That is to say he rega
reality as incessantly changing, always active, ever creative. Like Berg
and James he rejects the conception of a static, immutable Absolute,
“ block universe ” complete once for all. Cosmic activity proceeds
cycles, but is without a beginning and without an end. Within this t
spiritual activity certain phases, aspects, or factors may be distinguish
though not separated. First of all its *theoretical* activity may be dis
guished from its *practical* activity. And then within each of these i
possible to make two further distinctions. In the case of theoretical
tivity Croce distinguishes between *intuitions* and *concepts* (or thought
ideas). Intuition is the act of creating the materials of cognition, an
best exemplified in the creative vision of the artist. Here there is no se
material supplied to the mind from outside (as is commonly believed to
the case)—the mind just produces or creates its intuitions. Concept
thinking operates on intuitions and traces relations between them,
traces what is universal in them. Actually the concepts are immanent in
intuitions, and the two can never be separated. Intuitions without c
cepts would be blind ; concepts without intuitions would be empty.
concepts, however, have a certain special significance. They are comm
to all minds or spirits, and are the means of communion between th
They are universal, and are expressive of the universal Spirit tha
immanent in all finite minds. As to the objects to which theoretical
tivity must always be directed, they also are the creations of that activ
In fact the process of thinking, the object of thought, and the discrimi
tion between the activity and the object are all of them aspects of the sa
total experience. It is only by a process of abstraction that a world
seemingly independent objects is set up over against the world of thou
Turning next to practical activity, this is always volition, of course, si
there are no physical actions in a spiritual world. Practical activity is
pendent on theoretical activity, for volition depends on cognition. Cr
distinguishes two kinds of practical activity, namely economic acti
directed towards the useful, and moral activity directed towards
good. Economic activity is individual and egoistic ; moral activity is u
versal and altruistic. But, like intuition and conception, economic
moral activity are not separate, but only distinguishable phases of
same whole, so that every practical action has at once an egoistic an
altruistic character.

[*Estetica*, 1902 (Eng. Tr. *Æsthetic*, London, 1909) ;
Logica, 1905 (Eng. Tr. *Logic*, London, 1917) ;
Filosofia della Pratica, 1909 (Eng. Tr. *Philosophy of the Practical*, Lon
1913) ;
Storiografia, 1920 (Eng. Tr. *History*, London, 1921).]

G. Gentile (b. 1875) approaches philosophy from the standpoin
education, which he regards as a process of self-development culmina
in philosophy as the highest form of self-consciousness. For Gentile s
consciousness is ultimate reality. Self-consciousness is the one thing
are sure of, and it is a sufficient clue to the interpretation of reality, fo

ity can be adequately conceived as self-consciousness. For Gentile self-consciousness (or mind or spirit) is a more compact unity than it or Croce, who attributes to it four different kinds of activity. Gentile cts the view of such a quadruple cleavage, and insists on the complete y of self-consciousness. The inevitable distinction between the know-subject and the known object is no real difficulty, for in self-consciousness we find both, and it is the same mind that is at once subject and ct, or knower and known, and each of these is the whole mind, not ely a fragment of it. The object of cognition is therefore always con-usness or mind, which self-consciousness generates in thinking it, so "nothing is but thinking makes it so" in the very process of self-elopment. And just as the self-consciousness of a finite mind or spirit nmanent in each of its experiences, so the universal self-consciousness pirit is immanent in each finite self-consciousness. Finite minds are efore only moments or aspects of the universal mind which at once nd creates the universe. Although the subjective and objective phases noments of self-experience (finite or cosmic) are not really separate, yet are distinguishable. Art, according to Gentile, is mainly concerned the subjective aspect, whereas religion is mainly concerned with the ctive aspect. Philosophy, on the other hand, is concerned with the two ther, that is, with self-consciousness or reality in its integrity. Philo-ny, according to Gentile, is the complete form in which art and reli- are brought together and reconciled, so that it represents the Truth, plete actuality, or the Spirit. Thus the philosopher not merely con-plates reality, but in a measure creates it.

tto del pensare come atto puro, 1912 (Eng. Tr. *The Theory of Mind as ure Act*, London, 1922).]

Royce (1855–1916) was the best known American idealist. His philo-y was in some ways like the Absolute Idealism of Bradley. Beginning the consideration of finite ideas he pointed out that these are not images, but imply some mode of action, and therefore some purpose. purpose constitutes the internal meaning of an idea. Ideas, moreover, ess an external as well as an internal meaning, the external meaning isting in their reference to objects beyond themselves. But no object be real independently of the knowledge related to it. And in order to be ed the object and the idea must have something in common. From Royce concludes that the reality of these objects of reference consists eir fulfilment of the inner meanings of the corresponding ideas. The y of an object is thus conceived as the realisation in experience of the ose involved in the internal meaning of an idea. Whether this pur-is or is not fulfilled can only be judged by the idea itself, which is thus rued as having a purpose and will of its own. In this way thought to be conceived by Royce as a conscious life in which ideas embody purposes in objects. "To be" means, in the last resort, to express complete internal meaning of an absolute system of ideas," because y in its fulness must fulfil all ideas. And so finite ideas must be ned to be absorbed in one complete system of ideas and one all rehensive purpose which finds its satisfaction in the total realm of

existence. This Absolute Experience, of course, embraces also much t
is beyond finite experience. Royce, however, did not conceive of hum
individuals as merely engulfed in the Absolute, but as conserved in so
way. Each individual expresses in his own way something of the absol
or divine will, and so constitutes a unique part of the unique Wh
Even time, according to Royce, is not merely superseded, in the Absolu
by an eternity that is utterly different from it. He would say rather t
eternity is the Absolute's simultaneous apprehension of all time, so
what in the same way as a melody is the simultaneous apprehension
certain sequence of notes.

The moral philosophy of Royce is noteworthy for the novel chara
of its ultimate principle, namely, " loyalty to loyalty." By " loyalty "
meant a person's devotion to a cause greater than himself. When a p
son, who is loyal to one cause, also respects other people's loyalties to ot
causes, and co-operates with the spirit of loyalty wherever he finds it, t
he practises loyalty not only to his cause but also to loyalty genera
This is " loyalty to loyalty," the gradual extension of which Royce ho
would eventually bring to birth " the Great Community," and bring t
end all international discord.

[*The World and the Individual*, New York, 1900, 1901 ;
The Philosophy of Loyalty, New York, 1908 ;
The Problem of Christianity, New York, 1913 ;
Lectures on Modern Idealism, New York, 1919.]

W. E. Hocking (b. 1873) is still elaborating a philosophy which
describes as " mystical realism," but which admittedly also cont
some elements derived from idealism, naturalism, and pragmatism.
haps it is idealist first and foremost. This seems to be implied in Hocki
assertion that " idealism is not so much a separate type of philosoph
the essence of all philosophy." One of the most interesting feature
Hocking's philosophy is the view that sense experience is a common
between many selves, and that thereby we get to know directly not
other human selves but even God. " I have sometimes sat looking
comrade, speculating on this mysterious isolation of self from self.
are we so made that I gaze and see of thee only thy wall and never th
This wall of thee is but a moveable part of the wall of my world ; a
also am a wall to thee. We look at one another from behind masks.
would it seem if my mind could but once be within thine, and we c
meet and without barrier be with each other ? And then it has falle
me with a shock—as when one thinking himself alone has felt a pres
—that I *am* in thy soul. These things around me are in thy experie
They are thy own ; when I touch them and move them I change
When I look on them, I see what thou seest, and I experience thy
experience. For *where art thou ?* Not there, behind those eyes, wi
that head, in darkness fraternising with chemical processes. Of these
my own case, I know nothing and will know nothing ; for my exist
is spent not behind my wall, but in front of it. . . . And there art thou
This world in which I live is the world of my soul ; and being wi
that, I am within thee. I can imagine no contact more real and thri

this ; that we should meet and share identity, not through ineffable r depths (alone), but here through the foregrounds of common exence, and that thou shouldst be—not behind that mask—but *here* sing with all thy consciousness upon me, *containing* me, and these gs of mine. This is reality, and having seen it thus, I can never again rightened into monadism by reflections which have strayed from this ling insight." Hocking identifies the primary object of knowledge with e experience itself, and objectivity with social agreement. Man's gnition of the objectivity of Nature therefore presupposes the simulous recognition that at least one other self or mind has a like knowe of the same content. In the last resort, however, there must be a d other than human to give objectivity to Nature. For the human self self dependent upon Nature, so Nature cannot be dependent on it. " Other Mind," in the last resort, must therefore be God, the univerKnower, who gives objectivity to all knowledge, even to our knowe of our fellow men. Hocking, in fact, regards the whole world as a " This word self indicates chiefly that the mental life within the d has its unity, and that all the meanings of things cohere in a single " The ultimate evidence for the selfhood of the whole world is to be d in immediate experience. " We, as a group of human selves, know we are not alone in the universe : that is our first and persistent inon." But the self of the universe is infinite in its depth and mystery. human life is a reaching out to the reality of things as a region in h the discovery of value need never end. The human self spans past future, lives on values, and is free, determining out of a matrix of y possibilities which one shall become fact. But the human self is not ese things from the beginning—its freedom and its immortality must on. In these respects man is the creator of his own destiny.

Meaning of God in Human Experience, New York, 1912 ;
an Nature and its Remaking, New York, 1918 ;
Self, its Body, and Freedom, New York, 1928 ;
s of Philosophy, New York, 1929.]

VI. MONADISM OR SPIRITUAL PLURALISM IN ENGLAND AND RUSSIA

e Earl of Balfour (1848–1930) was apparently a defender of philoic scepticism. But his defence of philosophic scepticism was ind to be a defence of religious faith, or at least of a spiritual point of His early years had been spent in the atmosphere of the conflict een science and religion which followed Darwinism. Balfour was essed by the general assumption that the teachings of science were be- question. It appeared to him that the credentials of science (as exded in Mill's *Logic*) were no better than those of religion. And his ical attack on the foundations of science was planned in defence of oundations of faith. He contended that the two main " creeds " ion and science) by which human life is guided should be regarded ting on separate bases, and that discrepancies between the two must e regarded as more unfavourable to religion than to science. In his

later work he was not content with this divorce between science and
ligion, their mere agreement to differ, but tried to bring them into
closest possible harmony. He held that science itself can only be sa
from corroding scepticism if we assume the existence of God as the sou
of all knowledge. Contrasting his own with Descartes' escape from dou
Balfour said : " Descartes rests the belief in science on a belief in G
I rest the belief in God on a belief in science." He was not really scept
about science. He admittedly accepted common-sense beliefs and scie
as true, or at least as on the way to truth. But he insisted that the only
to justify such a conviction was to place it in a theistic setting. His m
reasons were as follows. Science is avowedly based on perception,
concludes in the end that the things perceived are really very diffe
from what they appear to be in perception. All the wealth and variet
the world of perception are reduced by science to systems of im
ceptible electrons and protons. Its conclusions seem to contradict
perceptual data. Again, according to the theory of evolution human ca
cities have been evolved as instruments of survival. They may not
capable at all of dealing with merely theoretical problems, which have
survival value. Yet our common-sense beliefs seem inevitable, and e
scientists and sceptics perceive things in the same way as others do,
make the same kind of assumptions about their causal connections,
The only ground for believing in the accuracy of these perceptions
assumptions, according to Balfour, is the supposition that all knowle
draws its inspiration from God, who guides human reason to its hig
results, which exceed the bare needs of survival, but are necessary to
ascent of man.

Turning next to the realm of morals, Balfour rejected the view that
highest loyalties, the most devoted love, the noblest self-sacrifice, c
be regarded as the waste product of the process of adapting human
ganisms to their environment. Natural Selection, he insisted, " mus
treated as the instrument of purpose, not simply as its mimic. . . . Et
must have its roots in the divine, and in the divine it must find its
summation." Similarly with æsthetic values. " When we look back
those too rare moments when feelings stirred in us by some beautiful
ject not only seem wholly to absorb us, but to raise us to the visio
things far above the ken of bodily sense or discursive reason . . . we r
believe that somewhere and for some Being there shines an unchan
splendour of beauty, of which in Nature and in Art we see, each c
from our own standpoint, only passing gleams and stray reflections."

Thus the three lines of argument converge to show, according to
four, that all that is best in human nature, whether associated with kn
ledge, goodness, or beauty, needs God for its support if it is to pres
its full value. And God is on the side of Truth, Beauty, and Goodn
He guides cosmic evolution, and from Him flows the inspiration w
helps the growth of knowledge, æsthetic joy, and love.

[*A Defence of Philosophic Doubt*, London, 1879, 2nd ed., 1920 ;
The Foundation of Belief, London, 1895, 8th ed., 1901 ;
Theism and Humanism, London, 1915 ;
Theism and Thought, London, 1923.]

. *Ward* (1843–1925) agreed with earlier and contemporary idealists
naintaining that actual experience does not involve a dualism of matter
mind, but a duality of subject and object, and that this duality-in-
y is consistent with a spiritual monism in which the unity of nature is
ceived to be the counterpart of the unity of experience. But, unlike
er idealists, Ward declined to make the Absolute his starting-point,
ferring to begin with the plurality of reals, and proceeding to find out
far such a more empirical and less speculative start may lead him.
begins, accordingly, by assuming the existence of an indefinite variety
sychical beings of all grades, some much higher than human minds,
ers much lower, but all tending to self-conservation and self-realisa-
. This conception of all entities as psychical, indeed conative, indivi-
s Ward based on the principle of continuity—the absence of leaps in
re. Now such mental, striving entities, or monads, must be endowed
spontaneity. They cannot be regarded as subject from the the first
erely mechanical laws. The prevalence of natural laws and the ap-
ance of mechanism in nature are best explained as the transformation
pontaneous activity into regular habits, which may easily appear
e even more regular or uniform than they really are, if we apply
hem statistical methods. Moreover, the co-operation and organi-
n of monads leads to progress by a kind of creative synthesis, just as
elody comes into being when single notes follow in a certain se-
nce, or a certain level of culture is attained when society is organised
ertain harmonious lines. As the final goal of such progress one may
k of " the eventual consummation of a perfect commonwealth,
rein all co-operate and none conflict, wherein the many have become
one realm of ends." In this way Ward believed that without any ex-
gant speculation he had succeeded in construing the world as a
lity of psychical beings, or monads, primarily independent as re-
s their existence, and yet always mutually acting and reacting upon
other, " an ontological plurality that is yet somehow a cosmological
." He felt, however, that all this seemed to suggest " some ground
nd itself." And he fell back upon theism to supplement his spiritual
lism. While rejecting the ordinary ideas about creation he held that
in some sense sustains the world by a continuous act of self-limita-
Ward realised, however, that the theistic part of his philosophy was
speculative than the rest. Like Kant he treated it as a matter of faith,
based the belief in God and in immortality on moral grounds.

uralism and Agnosticism, London, 1899, 4th ed., 1915 ;
Realm of Ends, Cambridge, 1911, 3rd ed., 1920 ;
hological Principles, Cambridge, 1918, 2nd ed., 1920 ;
udy of Kant, Cambridge, 1922.]

. *R. Sorley* (b. 1855) has devoted himself mainly to the ethical as-
of philosophy. Value experiences, he insists, are as much data of
rience as are sense-perceptions, and must be taken into account in
philosophical view of reality as a whole. The experience of value is
ctive, as is all experience. But experience also refers always to an
t other than the experience itself. This applies to value-experience

as well as to cognition. The fact that value-experience implies fee
and desire makes no radical difference. It may have reference to feel
or desires of persons who are as objective to the subject of the va
experience as physical things are to the subject of sense-experience. Va
are objective although, or just because, they are characteristics of
personal life. For persons belong to the order of reality. And they are
bearers of value, for values are manifested in their characters and li
The goodness of the good man is as objective as the man himself. If
objected that human life is more often a mere striving after values ra
than a realisation of them, even so, it may be pointed out, the m
principles which induce people to pursue ideals, even unattainable ide
are as objective as are natural laws, though they differ in the objec
orders to which they apply and in their modes of application. Nat
laws apply to phenomena in space and time, and their validity con
in their reality. Values apply to personal life, and their validity consis
expressing an ideal which people feel they ought to realise. Natural
constitute the causal order of the existing world ; values constitut
moral order. And a theory of reality must recognise and harmonise
orders. Sorley's solution of the problem is briefly as follows. The univ
consists of a Supreme Mind, or God, to whom finite minds and t
environment owe their reality. God is the creator, the essence and so
of all values, but is willing that these values should be shared by the
minds who owe their being to Him.

[*The Ethics of Naturalism*, London, 1885, 2nd ed., 1904 ;
Moral Values and the Idea of God, Cambridge, 1918, 2nd ed., 1921.

A. E. Taylor (b. 1869) is essentially a moral and religious philosop
He maintains that philosophy " has to be content to recognise that in
sciences, in history, in morality and religion, it is dealing with a re
which is in the end simply ' given,' and not to be explained away.'
fact he is more than suspicious of any system of philosophy that leave
unexplained mystery at the root of things. His own philosophy ma
seeks to harmonise the exigencies of scientific thought with the m
and religious demands of life. Morality postulates freedom on the pa
the agent and real contingency in nature. This, however, is not in
flict with science. For science itself recognises a principle of indeterm
tion. The natural order is not necessarily the only one. Taylor in
that there is no reason to suppose that religious experience is
cerned with anything less real than is any other part of human
perience, and that the reality of religious experience is evidence of
reality of its object. "It is only because the absolutely Good and utt
Adorable has not left Himself without a witness in our hearts that
feel the need of an object of worship and are driven from the worshi
trees or streams, or animals or mighty men or anthropomorphic dei
towards an object in which our adoration can at last find rest because
on which it is directed is adequate to sustain it." Taylor's view, acc
ingly, is frankly theistic. The ultimate ground of things, he holds,
single supreme reality which is the source of everything other than it
and has the characteristic of being intrinsically complete or perfect,

dequate object of adoration or worship. This supreme reality is best
ceived after the analogy of the human spirit at its very best. Thy
ity of moral progress, according to Taylor, postulates also the reality
ime, of causal agency, of free-will, and of permanent personality. The
al life is a life of tension between the temporal and the eternal, and
ly possible to a being which is neither abiding nor simply mutable,
both at once. It is a life of real adventure which begins with “ nature ”
ends in “ supernature.” The attainment of a fully unified person-
depends on our finding our principal good in God, the concrete
y of all good in its source. The implication of morality is thus a double
It points to the existence of God as the absolute and final plenitude
ood, and to an eternal destiny for the moral person whose aim is the
ion of the good. Taylor's religious philosophy culminates in the
logy from which, no doubt, he started. Its three main dogmas con-
ing God are these. (1) God is the Creator, Redeemer, and Sanctifier.
Ie is the lover of men. (3) The life of God is essentially an activity of
communication (which is the meaning of the orthodox doctrine of the
ity). Taylor also ventures to forecast the nature of man's life “ in
ven ” after his present life of “ probation.” The process of character-
ing will be over, but the activity issuing from character will remain.

Problem of Conduct, London, 1901 ;
ents of Metaphysics, London, 1903, etc. ;
Faith of a Moralist, London, 1930.]

. *O. Lossky* (b. 1870), the Russian philosopher, advocates an intui-
st epistemology and a spiritualist ontology. All knowledge is based
mmediate intuition. Objects are apprehended directly, without the
vention of mediating representations, but they are trans-subjective,
is, transcendent in relation to the consciousness which apprehends
in intuition. Intuition, however, is not yet knowledge. For although
ts enter consciousness in all their fullness and with all their relations
e another and to the rest of the world, yet the subject must exercise
owers of discrimination and integration in order to construe all these
s correctly. Then only is there knowledge. But the mind does not
e or construct these objects or their interrelations ; it only construes
. Knowledge only reflects, so to say, the objective facts and their
matic interrelations in the cosmos. This relationship between the
ct and the intuited objects is not the outcome of any causal operation
objects on the subject but is due to an “ epistemological co-ordina-
” perhaps a kind of pre-established harmony or mutual adaptation,
een conscious subjects and the objects of which they become con-
s. Lossky favours the conception of matter (or atoms) as events or
sses of attraction and repulsion. But he regards these processes as
festations of forces exercised by substances which are all spiritual
h only some of them are fully conscious. Physical processes are,
fore, never entirely mechanistic, but always psycho-physical, and
quently purposive, though not always consciously so. Lossky fol-
Aristotle and Driesch in assuming the operations of an “ entelechy ”
count for the peculiarities of organic life and behaviour. But he

conceives the principle of life not as a force but as a substance exercising creative activity of a being that is the source of its laws and not their sl The universe is conceived by Lossky after this analogy. The world says, is an organic whole. By an organic whole he means a whole whic prior to its parts, so that the parts can only come into being and conti to exist within the whole. And " the unity of the intelligible world is a functional unity of abstract ideas but a community of beings that an infinite life." But such an organic whole cannot be self-existent must be grounded on some higher principle. So the unity of the cos compels Lossky to recognise " a super-cosmic principle, the Absol as the source of a plurality of substances which form a unity more intir than the abstract unity of the world, and nevertheless remain free in t activity." In this way Lossky finds a philosophical basis for theism for Christian theology, in his " Organic Concrete Ideal-Realism," a calls his philosophy, which seems to oscillate between spiritual plura and absolute idealism.

[*Handbuch der Logik*, 1927;
The World as an Organic Whole, London, 1928;
L'intuition, la matière et la vie, 1928.]

VII. NEO-TRANSCENDENTALISM
(NEO-KANTIANISM AND PHENOMENOLOGY) IN GERMA

O. Liebmann (1840–1912) was mainly responsible for the Ger philosophic movement which took for its motto the refrain " Bac Kant," and is consequently known as Neo-Kantian philosophy. He to show that the philosophical systems of Fichte, Schelling, Hegel, bart, Schopenhauer, etc., although they all claimed to be the successo Kant, really misrepresented his views. For they all made the " thin itself " (or Absolute, etc.) the central idea of their philosophies, wh it played no such rôle in the philosophy of Kant, who regarded all kn ledge as restricted to the realm of relationships, and as incapable of re ing the thing-in-itself (or Absolute). Liebmann applied the same kin criticism to the empiricist or positivist tendencies in philosophy. The of experience, which positivism treats as ultimate facts, are not p objective entities, for they have already been affected by the general f of thought. Pure " matter " of sensation, any kind of entity or reality touched by the forms of cognition, is just as inaccessible to us as i thing-in-itself. Nor is there such a thing as " pure experience," in M sense, for all experience or empirical cognition is already determine certain logical principles by means of which we try to understand na phenomena. Liebmann enumerated four such principles, namely, t of real identity, of continuity of existence, of conformity to law, and c continuity of events—these four principles between them constit the " logic of matters of fact," which must be used in all scientifi vestigations, though not dogmatically but only regulatively.

[*Kant und die Epigonen*, 1865;
Zur Analysis der Wirklichkeit, 1879.]

. Cohen (1842–1918) was the chief of the Neo-Kantian philosophers.
was the first to give a full and critical interpretation of the philosophy
ant, treating the transcendental method as its central feature. Cohen
sted that a philosophical theory of knowledge must set out from the
t or mathematical sciences. Kant himself actually had Newtonian
nce always in mind, and, when attempting to put philosophy on the
path of science, he measured the scientific character of an investiga-
by the amount of mathematics which it contained. Cohen maintained
philosophy should ascertain the possibility, and the conditions of the
ibility, of all the ideas and principles which the exact or mathematical
nces of nature treat as their stock realities. Accordingly he paid special
ntion to the fundamental concepts of mathematics and mathematical
ics, studying more particularly the history of the method of infini-
nals. He endeavoured to show that the ideal of the infinitely small, as
by Newton and Leibniz, is really the fundamental intellectual
ument of the scientific study of reality. Cohen insists that reality is
r merely " given," whether in sense-perception or in intuition. It is
ys produced, in various ways, by means of thought. And it is the
tion of logic to trace these various ways in which thought produces
bjects. Kant's great merit, according to Cohen, was that he initiated
a " logic of origin," in place of the previous logic of ready-made
cts and forms. And Cohen set himself the task of developing this
of " logic of origin," so as to show how thought produces the real
cts of mathematics and mathematical physics. In a way, then, it may
aid that Cohen attempted to drop the teaching of Kant's trans-
ental *æsthetics* and to begin at once with the transcendental *logic*
nsing with the assumption of given sense material, and so identifying
y with thought. His system is, accordingly, described as " logical
ism."

ts Theorie der Erfahrung, 1871 ;
s Begründung der Ethik, 1877 ;
s Begründung der Aesthetik, 1899 ;
der reinen Erkenntnis, 1902 ;
des reinen Willens, 1904 ;
etik des reinen Gefühls, 1912.]

Windelband (1848–1915) attempted to save philosophy from the
ided tendency to pay undue attention to the natural sciences to the
ct of the historical studies, which are concerned with the various
s of human culture. This tendency had been encouraged to some
t by Kant, who had based his theory of knowledge on mathematics
nathematical physics. In his day these were the most scientific
es. History was classed with *belles lettres*, and left to the care of
y artists. But things have changed since then. History also is now
d in an objective or scientific spirit. It also is an empirical study.
its very difference from science may make it more helpful in the
of the problems of philosophy. Science is " nomothetic," that is to
is mainly concerned with the discovery of laws or regularities, and
is reason is general and abstract, is concerned with classes or types,

not with individuals as such, but only as specimens of the types. Histo
on the other hand, is " idiographic," that is to say, it is concerned w
individuals and individual events in all their particularity. And for
understanding of our ultimate problems a knowledge of the individ
and temporal (History) is more important than is the knowledge of
general and timeless (Science). It is sometimes urged that the histor
needs the aid of psychology, and psychology is a natural science. But
psychology that is of value to the historian is not the scientific psychol
of abstract generalities, but that concrete, intuitive understanding
men, and insight into character, which is an art rather than a science,
cannot be learned or taught. In relation to human interests and appre
tions of value, the unique or the individual is far more significant t
what is typical or general, for feeling is blunted by repetition. Histo
moreover, is concerned not only with the temporal and mutable, but
with the eternal. For although history is primarily concerned with
successive stages in the development of human culture, yet the cult
values with which it deals constitute between them a kingdom of eter
values, for their claims to universal validity imply the existence of a " c
sciousness in general." The eternal values (logical, ethical, and æsthe
realise themselves in history, namely, when men become consciou
them as " norms," or guiding principles, of conduct. To follow th
norms, or ideals, involves no breach with the natural laws of the m
For these norms themselves, as soon as we realise their validity
value, exercise a psychical force upon us. The same is true of our sens
responsibility. In this way education, including self-education, is poss
not in spite of natural laws, but through their mediation. Turning
to the questions of immortality and God, Windelband challenges
morality of Kant's moral argument. Is it moral, he asks, to feel the nee
a reward for virtue ? Man may, of course, do his utmost towards
realisation of the good, and so gain a kind of immortality through
participation in the eternal values ; but that is not what people commo
understand by immortality. This kind of individual immortality, howe
is not rendered probable by the modern tendency to regard the soul
function rather than as a substance. And the general acceptance of
theory of psycho-physical parallelism leaves no ground for the view
the soul can outlive the body. Windelband also finds it very difficul
reconcile the existence of God with the existence of evil. The worl
reality and the world of eternal values appear to him as an irreconcil
duality. They are not entirely divorced, for the one always points to
other. Yet the world of reality seems to contain much that is either ho
or indifferent to values. And this duality is unfavourable to a belief in
existence of God, though one might identify the Godhead with
World of Eternal Values. Windelband, however, admits that this dua
is an incitement to human endeavour. If the real were valuable, and
valuable real, man would have nothing to strive after.

[*Präludien*, 1884, etc. ;
Geschichte und Naturwissenschaft, 1894, etc. ;
Einleitung in die Philosophie, 1914 (Eng. Tr. *Introduction to Philoso*
London, 1921).]

. *Eucken* (1846–1926) was an impressive apostle of the life of the
t, in support of which he elaborated a more or less theistic or Chris-
metaphysic, though he rejected some of the most characteristic
nas of Christianity. The highest reality, according to Eucken, is a
itual Life, or Living Spirit, which is above Nature and yet pervades
such a way that Nature can be a stepping-stone to it. This super-
ral Spiritual Life is not something finished once for all but a living
ement towards ever greater and deeper spirituality. By some kind of
ical intuition man may get to know this Spiritual Life. He can also
cipate in its progress. All inspiration in science, art, religion, etc., is at
the outcome and evidence of such human participation in the Life of
pirit. For Truth, for instance, is not the creation of man. It exists in
Realm of the Spiritual, where man only discovers it. Only such a
tual source of Truth can account for our faith in the power of Truth
our devotion to the pursuit thereof. Truth, indeed, is the measure of
not man the measure of Truth. In the Life of the Spirit Truth has a
y and a value independently of man. Other evidence of the reality of
Realm of the Spiritual may be found in the fact that in times of tribu-
n most people seek refuge in this Spiritual Realm or Kingdom of
en. But real participation in it requires more than mere contem-
on ; it requires active moral endeavour, for the Spirit is essentially
l and the embodiment of all values. Nature, indeed, is not to be
rrated. For it embodies much intelligence, as is evident from the
and interconnections of natural phenomena, and from the natural
tion of increasingly higher orders of natural beings. Indeed, the
n mind itself is a product of Nature. Nevertheless, Nature stops short
irit, and is at best only a preliminary stage on the way to the Spiritual
For the Spiritual Life is not the product of Nature, but its ultimate
lation and goal. Hence although Eucken has every respect for
ce and its achievements, he maintains that it is history, the life-
s of great personalities, rather than science that brings us into
t contact with the Realm of the Spirit. He also insists that the intel-
l methods of science, the methods of discursive reason, though
are suitable for the acquisition of knowledge of natural phenomena,
ot adequate to the knowledge of the Spiritual Realm. For this pur-
another method is required, namely, the " noological " method, as
en called it. By this he meant some kind of mystical, intuitive pene-
n on the part of our whole personality (as distinguished from our
intellect) into the Life of the Spirit, which thereby takes possession
consciousness. Eucken sometimes spoke of this Spirit or Spiritual
n pantheistic terms, but for the most part he identified it with a
nal God, in the sense of theism. On such a philosophic and religious
rm Eucken took his stand and endeavoured to rouse his generation,
ke them see the superficiality of the materialistic culture of the age,
persuade them to strive after a deeper and more spiritual life.
n existence, he urged, is empty, and devoid of all significance, unless
n raises it to the other-worldly heights of the Life of the Spirit.

inheit des Geisteslebens, 1888 ;
ebensanschauungen der grossen Denker, 1890 (Eng. Tr. *The Problem*
Iuman Life, London, 1909) ;

Der Wahrheitsgehalt der Religion, 1901 (Eng. Tr. *The Truth of Relig*
London, 1901);
Grundlinien einer neuen Lebensanschauung, 1907 (Eng. Tr. *Life's Basis*
Life's Ideal, London, 1912).]

E. Husserl (b. 1859) is the leader of the philosopical movement kn
by the name of Phenomenology (not to be confused with Phenomenalis
Phenomenology is primarily an epistemological method, which may
traced back to various other philosophers of the nineteenth century,
more especially to F. Brentano (1838–1917) and A. Meinong (b. 18
Brentano, in his *Empirical Psychology* (1874), drew attention to
" referential " (or, in Scholastic terminology, the " intentional ") c
acter of mental processes. They all refer to an object, real or imagin
Whether we perceive, or imagine, or judge, or desire, or love, or ha
there is always " something " that we perceive, or imagine, or judge,
This fact served as the basis of Meinong's study of " objects as su
(*Gegenstandstheorie*), with a view to determining the *a priori* characte
various objects independently of the psychical experiences whose ob
they are, and independently even of their own existence. The Phenon
ology of Husserl is largely a development of this kind of epistemolog
method, though he eventually associated with it also an idealistic ontol
To begin with, Husserl emphasises the fact that consciousness or
perience, or cognition in particular, has two poles—a subject-pole an
object-pole (or a *noetic* and a *noematic* aspect). In other words, the
always a subjective activity, a correlated object on which it is directed,
some kind of nexus between them. There are many different kin
activities in consciousness (perception, thought, appreciation, etc.)
many kinds of correlated objects (existents, universals, values, etc.). An
application of the phenomenological method consists in living through
of these activities in turn, and introspectively observing the whole struc
of the activity and its object and the nexus between them (the su
and object " bracketed together," so to say). This procedure is diffe
from the ordinary consciousness with its almost complete absorptio
the object; and it is different from the usual psychological introspe
with its concentration on the subjective. The phenomenological me
started as a purely descriptive method proceeding by way of thoro
going analysis, and without making any presuppositions. It was inten
in fact, to carry out the main task of the Critical Philosophy in much
thorough fashion than Kant had done. Husserl meant his method t
transcendental and radical. At the first blush the tendency of his me
appears to be realistic. Husserl, for instance, maintains that physical
jects (unlike mental experiences as such, or also universals) can onl
apprehended in part or in perspective, so that apparently they are al
objectively more than what they are in empirical consciousness. Bu
tendency soon appeared to be definitely idealistic; and it looks as thoug
idealistic ontology had influenced Husserl's phenomenological me
from the very beginning. The points of more general interest ma
briefly indicated as follows. The mind's objects and the activities by w
it apprehends them are not ultimately different in kind, only in de
The acts of the mind may themselves become its objects, and the mi

as active when it has itself and its activities for its objects. What the l gets to know of its objects is only their " whatness," not their atness," that is their universal characters, their " essences," not their liarities as particular existents. The phenomenological method is a nod of " intuiting essences " (*Wesensschau*). In the last resort, more- , the " essences " which the mind comes to know are really the forms s own *a priori* activity. Husserl seems to assume that all " being " is ing in consciousness." The objectivity of objects is due to the fact over and above the empirical ego there is a transcendental ego, in ion to which the empirical ego is only one object among many. And the transcendental ego that constructs all objects and their essences rding to its own *a priori* forms. Lastly, all the transcendental egos ly constitute one supreme transcendental Being or Spirit, rather like Absolute of Hegel.

ische Untersuchungen, 1901, etc. ;
i zu einer reinen Phänomenologie, 1913, etc. (Eng. Tr. *Ideas*, London,
31) ;
iale und transzendentale Logik, 1929.]

VIII. BIOTISM, VITALISM, PRAGMATISM, INSTRUMENTALISM, AND FICTIONISM IN FRANCE, GERMANY, AND THE UNITED STATES

Bergson (b. 1859) marks the climax of the reaction of French Philo- y against scientific mechanism. His philosophy is mainly directed to indication of the spiritual character of the universe as a whole, with- lenying altogether the reality of matter and of natural law. The key epts of his system are those of change, activity, freedom, creative tion, duration, and intuition ; and his philosophy is commonly ribed, accordingly, as the " philosophy of change " or of " creative tion."

timate reality, according to Bergson, is neither material nor mental, omething less determinate from which both mind and matter derive. " change," a flow of events, a surging of *life*, moving incessantly to forms. It is not static, though he also calls it " duration " or real But this must not be conceived abstractly as a mere sequence of nts. " Duration [says Bergson] is the continuous progress of the past n gnaws into the future and which swells as it advances." This is seen in the case of human life. Our whole past follows us at every nt. " All that we have felt, thought, and willed from our earliest cy is there, leaning over our present, which is about to join it. . . . are we, in fact, what is our *character*, if not the condensation of the ry that we have lived from our birth—nay, even before our birth, we bring with us parental dispositions ? Doubtless we think with a small part of our past, but it is with our entire past . . . that we e, will, and act." Such is duration or real time. In it the whole past

is telescoped in the present. Moreover, it involves not only real and in
sant change, but a certain freshness or novelty in every new change, s
each successive change in a sequence has a richer past permeating it.
sequence of changes is, therefore, a creative evolution. Spirituality is
this kind of memory, this kind of concentrated activity in which the
interpenetrates the present. But sometimes there is a relaxation of
activity, and the result is matter. Broadly speaking it may be said that c
sciousness is interpenetration without externality, whereas matter is
ternality without interpenetration.

Now the evolution of life has followed three different and indepen
directions—the vegetative, the instinctive, and the intelligent (or ratio
Instinct is the faculty of using organic instruments ; it is a kind of
conscious practical skill. Intelligence is the faculty of making and u
inorganic instruments, and develops into conscious thought about r
tions between things. Intelligence (owing to its original function of mal
inorganic tools) tends to regard all reality as though it were inert ma
Hence the scientific tendency towards mechanistic explanations.
tendency must be corrected by means of intuition, which is instinct
come self-conscious and capable of reflecting upon its objects. But
tuition and intelligence must co-operate if we are to avoid mechan
at one extreme, and mysticism, at the other.

For Bergson, consciousness or spirituality is exemplified by mem
not by perception. Perception is only incipient or nascent action, not
sciousness at all. The contrary view is based on the frequent minglin
memory with perception. This only shows that spirit can rest on ma
yet they remain distinct. Similarly, however intimately consciousness
be connected with the body, or with the brain, they are nevertheless
tinct. Consciousness is not a mere function or epiphenomenon of
brain, but rather uses the brain as an instrument. “ There is a close
nection between a coat and the nail on which it hangs, for if the na
pulled out the coat falls to the ground. Shall we say, then, that the sl
of the nail determines the shape of the coat, or in any way correspond
it ? ” No more is one entitled to say that psychical facts are determ
by the cerebral facts with which they are associated. And mind is es
tially free or creative, not mechanical, in its activity. Even if it is adm
that our past influences our present, our freedom is not affected ther
For freedom is essentially self-expression, self-determination, and
conduct is free just when it expresses what we are.

The functions which Bergson attributes to matter are not entirely
It is the principle of individuation, it divides the sea of life into sep
individualities who can each develop distinctive personalities. More
the very obstacles which matter presents serve as an incentive to th
tensification of activity, which is life. “ By the resistance matter o
and by the docility with which we endow it, it is at one and the
time obstacle, instrument, and stimulus.” Life, however, always re
a certain corporate, social, or integral character, which prevents its
sipation in sheer, incoherent individualism. Life finds full satisfa
only in society. The best and most live man is “ the man whose ac
itself intense, is also capable of intensifying the action of other men,
itself generous, can kindle fires on the hearths of generosity.” In th

rt, moreover, " all the living hold together." The central radiation of s God. And God is " unceasing life, action, freedom."

ai sur les Données immédiates de la Conscience, 1889 (English Tr. *Time d Free Will*, London, 1910);
ière et Mémoire, 1896 (Eng. Tr. London, 1911);
olution créatrice, 1907 (Eng. Tr. London, 1911);
ergie spirituelle, 1920 (Eng. Tr. *Mind-Energy*, London, 1920).]

. *Driesch* (b. 1867) is the leader of contemporary Vitalism or Neo-ism, the chief tenet of which is that the phenomena of life cannot be uately explained in terms of physico-chemical processes. Driesch cates a " dynamic teleology " in opposition to the mechanistic ry of life, according to which all vital phenomena are determined y by physico-chemical factors. Driesch adduces the following evi-e against biological mechanism. (*a*) A complete organism can be loped from an incomplete egg. Any one cell of a two-, four-, or eight-d blastula (segmented ovum) can produce a complete embryo; and cell of the four-celled blastula produces a different organ according ne or more of the remaining cells have been removed. Hence some al vital factor must be operative, over and above the physico-nical factors. (*b*) Similarly, in the case of the blastula of the echino- (the sea-urchin, etc.) which is normally formed by the division of the any one cell, or group of cells, can function instead of the whole This is beyond mere mechanism. (*c*) If part of the brain of a living al is removed, then after some time its functions are carried out by er part of the brain. (*d*) In the case of human behaviour experiences ccumulated and stored in the form of ideas. Now there are certain anisms which in a sense accumulate experiences. A phonograph, nstance, does so. But this kind of mechanistic storing is totally ent from that through ideas, which can, moreover, be used for the ruction of other, new ideas.

al reactions, then, according to Driesch, are not to be explained anistically. They are more like intelligent replies to a question, or nutually responsive parts of a conversation. What determines the reaction is the complete animal or some vital unit which functions e whole animal. In this connection Driesch re-introduces the Aris-an idea of an *entelechy*. An entelechy is, so to say, a plan pervading ng organism, and its power is revealed in the development of the ism, and in all its biological reactions. If, for instance, a triton loses t, the entelechy responds by forming a new one very like the lost And so in all cases where special re-adjustments are called for, as e examples mentioned above.

iesch has applied the idea of entelechy also to the study of psycho-He treats psychology in a kind of behaviouristic manner as con-d with the study of organisms in action. Animal behaviour (includ-uman behaviour) is very like animal development. Both are directed ertain purpose or end. And just as the development of an animal is ed by an entelechy, so its behaviour is directed by an analogous *psy-* or an inborn intelligent urge to action. This urge finds expression in the first movements of new-born animals. It is prior to all exp ence. In course of time the animal accumulates experiences and acqu knowledge by which its activities are then regulated. In this way " sec dary purposes " and " secondary knowledge " come into being, as tinguished from the " primary purpose " and " primary knowledge " the original " psychoid."

Driesch, though primarily a biologist, has developed a full-fled philosophical system somewhat on the lines of German Idealism. haps the most interesting feature of his system is the way in which dominated by his idea of entelechy. He inclines to conceive God, or Absolute, as the ultimate Entelechy of the Universe, and as the ultin Potentiality of all that comes into being. The conception of such a di entelechy, considering the teleological character of entelechies, natur inclines Driesch to believe (though he admits that he cannot prove) the world has some ultimate purpose.

[*Analytische Theorie der organischen Entwicklung*, 1894 ;
Science and Philosophy of the Organism, London, 1908 ;
History and Theory of Vitalism, London, 1914 (German original 190
Problems of Individuality, London, 1914.]

W. James (1842–1910) was the leader of the American philoso movement known as Pragmatism. This term was first introduced in by C. S. Peirce (1839–1914), and the main idea has been traced to ancient Sophist Protagoras, who taught that " man is the measure o things." The philosophy of James is perhaps best understood as a r tion against the excessive intellectualism, and the monism or singula of absolute idealism and its conception of an eternally finished s world or " block universe." He had a keen feeling for what lives moves. And to this feeling may perhaps be traced the most distin factors in his philosophy—its pluralism, individuality, freedom, nov To some extent he was influenced by Renouvier, the French defend free-will against scientific determinism. Hence there is a certain aff between James and Bergson. Already in his psychology James laid s on the *activity* of consciousness or experience, which, under the influ of emotional and practical interests, selects for attention only ce things from a " theatre of simultaneous possibilities," and in this s " carves out " a world of its own in " the jointless continuity of space moving clouds of swarming atoms." Turning to human knowle James distinguished between *knowledge by acquaintance* (in which ob are apprehended immediately) and *knowledge about* (in which objects known indirectly by means of ideas). James's pragmatism shows i in his interpretation of ideas by reference to the practical effects invol the sensations to be expected, the reactions which have to be prepa " Thinking is first and last and always for the sake of doing," and " conception with which we handle a bit of sensible experience is r nothing but a teleological instrument." This implies that ideas mus tested either by the realisation of the sensory expectations or by the cess of the prepared reactions. " The ' true ' . . . is only the expedie the way of thinking, just as the right is only the expedient in the wa ehaving. Expedient in almost any fashion; and expedient in the run, and on the whole, of course." If an idea cannot be tested by the nent of sensory expectations we may legitimately "will to believe" emotional and practical interests favour it. The idea of God, for ce, is a case in point.

es's world-view, like his pragmatic method, was also largely the me of his psychology. He found in "experience" all that was sary for the construction of reality. As against the idealist assumption 'relations" are the special creations of consciousness, and that a endent Spirit has to be assumed to sustain the unity of the cosmos, contended that "conjunctive relations are just as much matters of experience" as are things. In fact, consciousness itself is only one of conjunctive relation among experiences. The system of external es, and the stream of our internal thinking, are really the same erience" taken in different relations. Such was James's "radical icism." His psychology also disposed James to accept the reality of a human consciousness composed of all finite minds. This view seemed justified by the evidence of psychical research (automatic writing, mship, etc.), the phenomena of multiple personality, and above all "varieties of religious experience." These persuaded him of the nce of reservoirs of consciousness, "a more of the same quality" as minds, a plurality of saving powers, with which man sometimes into contact. James approved of theism, but regarded God as or of limited power and responsibility. The world, according to , is undetermined, so that it is quite possible to realise in it whatever asonably think ought to be realised. The good man is a "faithful " in the cause of righteousness, and is justified in his faith in the te triumph of goodness.

iples of Psychology, London and New York, 1890;
ill to Believe, London and New York, 1897;
ies of Religious Experience, London and New York, 1902;
atism, London and New York, 1907;
alistic Universe, London and New York, 1909;
eaning of Truth, London and New York, 1909;
Problems of Philosophy, London and New York, 1911.]

ewey (b. 1859) teaches a form of pragmatist philosophy known as umentalism." Thought, he maintains, is essentially an instrument So long as life proceeds smoothly people do not think. It is only he impulse to action is thwarted in some way that people pause to Their thought is an attempt to plan their action so as best to meet ficulties of the situation. And the validity of their thought is gauged success—"that which guides us truly is true." The sciences may to be interested in knowledge for its own sake. The highly abstract dge which they accumulate may appear to be remote from the al needs of life. In reality, however, the whole quest for truth is an te and potent method of forging effective instruments for the future of our practical life. The object of thought is, accordingly, conas an ideal, that is, a plan of action. The object is, consequently, not

regarded as something ready-made, but as something which is prog
sively constructed by the activity of thought. In such a philosophy
moral problem is naturally supreme. Indeed, the initial motive of Dew
" instrumentalism " appears to have been his desire to overcome
traditional dualism in logical standpoint and method between " scier
on the one hand and " morals " on the other. " I have long felt
Dewey] that the construction of a logic, that is a method of effe
inquiry, which would apply without abrupt breach of continuity to
fields designated by both of these words, is at once our needed theore
solvent and the supply of our greatest practical want." And what ch
prompted his desire to produce such a joint, practical logic was
enthusiasm for social progress towards liberalism in the highest
widest sense of the term. Instrumentalism is conceived by him as affor
a suitable philosophic basis for such liberalism, in so far at least as
opposed to all that is static and obstructive, and encourages experimen
enterprise in social reconstruction. But, like Windelband, he also m
tains that " the next synthetic movement in philosophy will emerge
the significance of the social sciences and arts has become an obje
reflective attention in the same way that the mathematical and phy
sciences have been made the objects of thought in the past, and
their full import is grasped." One of the chief obstacles in the wa
advancing beyond the legacy of that " provincial episode " know
Western European history, is the solicitude of many people abou
present and future of religion. But, thinks Dewey, such people
moved more by partisan interest in a particular religion than by int
in religious experience " as such.

[*Studies in Logical Theory*, New York, 1903 ;
Essays in Experimental Logic, New York, 1916 ;
Democracy and Education, New York, 1916 ;
Reconstruction in Philosophy, New York, 1920 ;
Human Nature and Conduct, New York, 1922 ;
Experience and Nature, New York, 1925 ;
The Public and its Problems, New York, 1927 ;
The Quest for Certainty, New York, 1929.]

H. Vaihinger (b. 1852) has formulated an idealistic positivism
monly known as " the philosophy of ' as if,' " or " fictionism." It
bines Kantian positivism (which confines human knowledge to
empirical) and pragmatism (primacy of the practical reason)
Schopenhauer's voluntarism and pessimism, Darwin's evolutionism
Mill's empiricism (which reduced reality to sensations and perma
possibilities of sensation). He holds that psychological analysis en
sensations, feelings, and conations, that epistemological analysis en
sense-data (or contents of sensation), while physical analysis ends in
and motion. So far as practical life is concerned all these diff
ultimate realities harmonise quite well, but thought cannot co-ord
them in one rational system. This is due to the fact that though
originally only an aid in the struggle for existence, and is still inca
of dealing with purely theoretical problems. What has happened in the

ought is only one instance of a common natural tendency. Namely, was originally only a means to a certain end may develop far beyond eeds, and emancipate itself from its end to such an extent as to become d in itself. In this way thought has come to be regarded as an end in , and has set itself tasks which are quite beyond it, such as the ion of the problem of the origin and significance of the universe, and ar metaphysical problems. But the solution of such problems is nd thought—not merely beyond human thought, but beyond any ght as such. Many ideas are, in fact, just deliberate fictions affording ly apparent solutions of theoretical problems. In addition to their rically verifiable hypotheses, the sciences contain many such erate fictions. So do ethics, æsthetics, and religion. What we call y consists of the contents of our sensations, or sense-data, which themselves upon us so that we cannot deny them. They exhibit laws or regularities of coexistence and of sequence ; and it is the ess of the sciences to ascertain these laws. By means of those sense-which we call our bodies we can exercise considerable influence upon est of the world (consisting of other sense-data). This world contains manifestations of purpose, but also much that is purposeless. We take the world as we find it. Myths may be helpful, morally or tically. Many people find satisfaction in the fiction that the world has created, or is governed, by a supreme and perfect Spirit. But this res the complementary fiction of an evil opposing power. As to the icance of the world, man must by his practical endeavours try to gnificance and value into it ; he must not expect to *find* value and icance there ready made. Practical life and intuition are higher speculative thought. In our practical contact with reality all specu- riddles disappear, and our practical work in and for the world is ore important than our theoretical speculations about it.

Philosophie des Als Ob, 1911 etc. (Eng. Tr. *The Philosophy of "As* ' London, 1924).]

REALISM, EMERGENT EVOLUTION, AND FLUXIONISM IN ENGLAND, SOUTH AFRICA, AND THE UNITED STATES

Alexander (b. 1859) has constructed a philosophic system which has eat merit of unusual harmony with the broad results of modern e and with the whole spirit of science. The stuff of the world, ac- g to Alexander, is Space-Time. Space alone is a mere abstraction, so e alone. The concrete reality is the four-dimensional Space-Time. s the same as pure Motion, for Time is not static. But pure motion yet matter in motion, for matter has to be generated first. Within hole of Space-Time, or pure Motion, point-instants may be dis- shed. These are the elementary events. Space-Time has certain rial characteristics which are consequently pervasive characters of stents. The categorial characters are existence, universality, rela- order, substance, quantity, number, motion. But besides these sal characters there are also various empirical qualities which distinguish different classes of objects emerging under special conditi For Space-Time differentiates spontaneously into many different figurations or collocations of point-instants. The simplest of these c sist of motions of various velocities and extents. But when these, or s of them, form certain patterns, then a new quality, namely materia emerges. Under certain further conditions such qualities as colour, sc etc., emerge. Given certain additional conditions, and life emerges. when such living complexes realise certain further conditions, then sciousness emerges as an additional quality of living bodies. Hen hierarchy of existents, in which whatever has the higher qualities alsc the lower ones from which they emerged. But the relation of a thing t highest quality is different from its relation to the lower ones. It “ joys ” (or has a direct living apprehension of) its highest quality, but “ contemplates ” (or has a merely external apprehension of) the lo qualities. Thus man, for instance, when he perceives a body (m his own body), “ enjoys ” the process of perceiving, and “ contempla the body. Every conscious process is also a neural process. Wha in this case, “ enjoyed ” as a conscious process is also “ contemplat as a neural process. A mind is the substantial continuum of proc which have the quality of consciousness. Its cognition of objec a special case of the more general relationship of “ compresence togetherness of things, and does not change in any way the qua of the objects cognised. Now although consciousness is the hig quality of human beings, it is reasonable to suppose that there are higher qualities in the universe. The highest quality is called by A ander “ deity ” or divinity ; and “ deity ” is conceived to be the hig quality of God in the same way as consciousness is the highest qu of man. The whole universe is the body of God. But mind is one of his lower qualities. What kind of a quality “ deity ” is we ca tell. But its nature may be assumed to be changing. For the univer never complete, and new and higher qualities may continue to em So that “ deity ” is always becoming, always yet to be. But Go the whole universe tending towards deity exists always. And this counts for the human longing for God, and for communion with It is the world with its nisus towards deity that stirs this longing i Practical religion consists in doing our part so as to advance the wo progress towards deity, by helping the good to triumph over ev human affairs. As to the relation of the finite many to the infinite “ the One is the system of the many in which they are conserved, no vortex in which they are engulfed.”

[*Space, Time and Deity*, London, 1920.]

L. T. Hobhouse (1864–1929) elaborated a philosophy which ma described as a form of evolutionary realism, but which is specially n worthy for its endeavour to effect a compromise between a numb philosophical antitheses—monism and pluralism, idealism and mate ism, empiricism and rationalism. Under the influence of Bosanqu embraced the view of the systematic or organic function of rea Immediate judgments are not final. “ The basis of rational judg

n the inter-connection of judgments. . . . The whole rests upon the
and in turn maintains them, and it is this organic principle of mutual
ort through inter-connection which is the Reason.” The speculative
n is the continuous and comprehensive effort towards harmony in
udgments which interpret experience. The practical reason is the
impulse applied to all of our experience that we value. But it is a
ke to assume that the whole somehow explains the parts, without
ng also the explanation of the whole in the nature of the parts which it
together. This mistake is mainly responsible for the idealist identi-
on of knowledge with reality, in violation of the claim of knowledge
er to objects beyond itself. “ Nothing exists because it is known, but
wn because it exists.” “ Briefly, there is in the nature of knowledge
no ground for restricting the nature of the known or knowable.
they are must be learnt from the reports of our immediate judg-
s in so far as their deliverances are reduced to consistency.” Know-
is the correlation both of immediate judgments and of objects, for
nterconnected system of judgments asserts a Reality of intercon-
d objects. This is so, not because objects must adapt themselves to
ht, but rather because thought has learnt to accommodate itself to
jects. But the extent of the interconnection of objects must not be
erated. We must distinguish between *organic* and *harmonic* unity.
is organic unity wherever there is some degree of both mutual
dence and independence among the parts. The greater the mutual
dence, the greater is the tendency towards harmony ; the greater
independence, the greater are the opportunities for conflict. Now
y has an organic unity, but is only slowly moving towards the
nic ideal. Mind with its teleological activity is the tendency to-
interrelation and harmony. But in so far as there are also inde-
nt or uncorrelated factors in existence, Reality is also characterised
echanism. Yet the characteristic process of Reality as a whole is
pment. And the end of its development is not the peace of death, but
rmony which keeps all things alive. The spiritual power, the prin-
f goodness that dwells in the world will some day come to its own.
not inherent in the tendencies of things as such, but results from a
to co-ordinate them. There is no evil principle in the sense in which
s a good principle. And so the world is worth living in, and fighting for.

heory of Knowledge, London, 1896, 2nd ed., 1921 ;
n Evolution, London, 1901, new ed., 1915 ;
in Evolution, London, 1906, new ed., 1923 ;
pment and Purpose, London, 1913, new ed., 1929 ;
Development, London, 1924.]

loyd Morgan (b. 1852) is largely responsible for what is known as
ilosophy of *emergent evolution*. His general attitude is realistic or
ic. He accepts the reality of a physical world of events interpretable
is of a four-dimensional space-time frame. These physical events
st an ascending hierarchy of kinds of relatedness in the case of atoms,
les, organic cells, and organisms respectively, each succeeding
volving the preceding. He also assumes a correlation of psychical

with physical events. When certain physical events occur in the cor of the brain there is consciousness. But this correlation is without a bre There are no physical events, or systems of such events, which are also psychical events, or systems of such events. There are not two wor a physical and a psychical, but one world, which is psycho-physical fr top to bottom. What we call “ things ” are clusters or systems of phys events regarded in abstraction from their psychical correlates. Eve come together to form systems of all degrees of complexity. In any s system it is possible to distinguish between its *stuff* and its *relations*. simpler systems may constitute the stuff of more complex systems. Th *e.g.*, electrons are the stuff of atoms, atoms of molecules, molecules the stuff of a drop of water, and so on until we reach vital events in cellular tissues which are the stuff of the organism. Each of these syst has its special set of relations, which are called *intrinsic* if within any system, and *extrinsic* when they interrelate two or more systems. Mo over, these systems are objectively real ; they are not carved out continuum by our interests. Mind is wholly intrinsic to the indivi percipient, but stretches out into the external world through consci reference to things in that world, which thereby become its object reference. This is possible because each receptor pattern has its psychic sign which is projicient in such a way as to subserve behavi In this way the skeleton of independent physical events is clothed flesh and raiment by the construction of psychic signs projiciently refe to them as the objects signified in perceptual experience.

The world at large consists of (1) physico-chemical events, (2) events which occur only in organisms, and (3) mental events which o only in some organisms. In vital events there is a new kind of related that does not obtain among merely physico-chemical events ; and mental events there is a further kind of relatedness that does not obta merely vital events. In other words, vitality is an emergent (or un dictable) quality of organisms ; and mentality is an emergent qualit some animals. But the emergent quality does not supersede the ol only supplements it. A system of vital events remains also phys chemical ; and a mental system remains also a vital one. But the phys chemical processes in a living organism are rather different from t in an inorganic one ; and the vital processes in a mental system are ra different from those in a merely living one. As a man of science L Morgan fully accepts its naturalism with natural piety. But if, as a ph sopher, he is asked to account for the direction of emergent evolution can only suggest that the scientific conception of evolution may be sup mented by the concept of the progressive unfolding in time of revelat of that “ Activity ” which is universally enfolded *sub specie æternit*

[*Animal Life and Intelligence*, London, 1890 ;
Habit and Instinct, London, 1896 ;
Interpretation of Nature, London, 1905 ;
Animal Behaviour, London, 1908 ;
Instinct and Experience, London, 1912 ;
Emergent Evolution, London, 1923 ;
Life, Mind and Spirit, London, 1926.]

N. Whitehead (b. 1861) has taken upon himself the task of repairing
philosophic damage done by his fellow mathematicians. Mainly
igh the influence of the highly abstract methods of mathematics
re, so rich in direct experience, has been reduced to something
indless, scentless, colourless, merely the hurrying of material, end-
y, meaninglessly." Mathematical physicists have taken the cosmic
n to pieces (fortunately in thought only). Whitehead tries to put it
her again by means of his " philosophy of organism." It is the am-
n of this philosophy to vindicate the reality not only of secondary
ties but of all that contributes to the æsthetic, moral and religious
of humanity, and at the same time to do justice to the legitimate
s of science. The mechanistic tendency of science and its materialism
ue to its concentration on abstractions, merely logical entities. Actual
ience is always an experience of concrete events. These concrete
s may legitimately be analysed into simpler elements or aspects,
ded these abstractions are not hypostatised as such, and treated as
gh they were self-contained realities. The actual events of experience
oncrete systems, or " organisms," in which the character of the
e (like the " entelechy " of Aristotle and Driesch) influences the
characters of various subordinate parts, elements or events which
itute it. " Organism," in this extended sense of the term, is a charac-
ic of all reality, and is not restricted to living organisms. It is a fun-
ntal feature throughout the whole of nature. Physics, according to
ehead, is the study of the smaller organisms (atoms, etc.), whereas
gy is the study of the larger organisms. Whitehead not only mini-
the contrast between the organic and the inorganic, he also rejects
ualism of mind and body. The mind is treated simply as a special
isation of the system of events that constitute the body, and the
r activities rendered possible thereby. But this must not be taken
an that Whitehead thinks in terms of " substances." Following the
of recent physics, he takes " events " for his units. The universe
ts of events and their interrelations. Events vary in complexity.
arger events are systems of lesser events and eventually of " atomic "
s. Reality is thus conceived as a flux, after the manner of Heraclitus,
h Whitehead also tries to salvage something of Eleatic permanence
siting Forms, " eternal objects," or universals, somewhat after the
er of Plato. " In the inescapable flux, there is something that abides ;
overwhelming permanence, there is an element that escapes into
Atomic events are called " actual occasions " (also " actual enti-
so that an event in the more general sense is a nexus of actual
ons, interrelated in some determinate fashion in one extensive
um. What is commonly called a thing or a person is a society of
, or a systematic stream of such events, having a certain causal
uity. Now each actual occasion is related to every other actual
on in the universe, and so the universe is one compact, organic
n of actual occasions, an " interlocked community " of events. And
gh this mutual interlocking of events it may be said in a sense that
ything is everywhere at all times." The Space-Time continuum is
with Alexander) a primitive datum but a construction from the re-
between actual occasions. The " interlockings " of actual occasions

are called " prehensions," and are conceived causally. Each actua casion is generated from its prehensions of preceding occasions, ar prehended by succeeding occasions. The process thus resembles son's conception of the telescoping of the past in the present. In this each actual occasion attains " objective immortality " in spite of flux. The " togetherness " of the universe, " the principle of co tion," is identified by Whitehead with God. " God is not concrete He is the ground of concrete actuality." " The World is the multip of finites seeking a perfected unity." God is " the unity of vision se physical multiplicity." " He is the lure for feeling, the eternal ur desire," and each creature has its " prehension " into God. " The t of Cosmology, which is the basis of all religions, is the story of the namic effort of the World passing into everlasting unity, and of the majesty of God's vision, accomplishing its purpose of completion b sorption of the World's multiplicity of effort." But " neither God the World reaches static completion. Both are in the grip of the ult metaphysical ground, the creative advance into novelty."

[*The Concept of Nature*, Cambridge and New York, 1920;
Science and the Modern World, Cambridge and New York, 1926;
Religion in the Making, Cambridge and New York, 1926;
Process and Reality, An Essay in Cosmology, Cambridge and New
1929.]

G. E. Moore (b. 1873) may be said to have taken up again the which T. Reid (1710–1796) waged against the excesses of " the w ideas." Like his prototype, Moore is a defender of " common se Negatively, his main contention is that idealism has not made out it on behalf of the sole reality of what is mental. There is, therefor reason for abandoning the common-sense assumption that there material facts as well as mental facts. Positively Moore has done more than enumerate a series of realistic propositions embodying hi *credo* as well as that of common sense. This may be summed up brie follows. (1) There is no good reason to suppose that *every* physica is logically or causally dependent upon some mental fact. (2) Ther and have been material things. (3) There are and have been many s Perhaps rather unlike common sense, Moore does *not* hold that th good reason for believing in the existence of God, or in human su after the death of the body. As a philosopher especially interested theory of knowledge, Moore is deeply concerned about the c *analysis* of the propositions which he accepts as true, namely those b summed up in (2) and (3) above. What exactly is known when it is as for instance, that " this is a hand " ? " Two things only seem to me quite certain about the analysis of such propositions . . . namel whenever I know, or judge, such a proposition to be true, (1) th always some *sense-datum* about which the proposition in questio proposition . . . and (2) that, nevertheless, *what* I am knowing or ju to be true about this sense-datum is not (in general) that it is *it* hand . . . etc., as the case may be." " In other words, to put my v terms of the . . . ' theory of representative perception,' I hold . . . th *rectly* perceive *my hand*; and that . . . I perceive . . . something which *representative* of it, namely, a certain part of its surface." But how y the representative sense-datum is related to the actual hand he ot know, for he is not satisfied with the various solutions suggested to. Similarly with the proposition " there are and have been many ." He is certain of its truth, but unaware of its correct analysis.

ipia Ethica, Cambridge, 1903;
, London, 1911;
ophical Studies, London, 1922.]

). *Broad* (b. 1887) is chiefly known for his Object Theory of Sensa. s theory there are three entities involved in every perception. First, re states of mind, called sensations. Secondly, these sensations have s, called sensa, which are concrete particular existents, like coloured patches, or noises, or smells—the sensa actually having the attri- of shape, size, hardness, colour, loudness, coldness, etc. Thirdly, re physical objects, the existence of which, and their presence to our , we are led to believe in by the existence of the sensa and their ce to our minds in sensation. The properties which we ascribe to ysical objects are always correlated with and based upon the ties of the sensa, but are not always identical with them. When we raight down upon an object, and the sensum is round, the object will also be regarded as round; but when looking at an object ely, the *elliptical* sensum may make us believe that the physical is round. As a rule we are not interested in the sensa as such, but physical objects of which they are the appearances. For it is the al objects, not the sensa, that can help or hinder us in the struggle stence.

ning from Epistemology to Ontology, and more especially to the n of Life to Matter, Broad favours the theory of Emergence. ling to this theory there are certain wholes composed of certain uents in a certain relation, and they are such that the character- operties of the whole cannot be deduced from the properties of the nents either in isolation or in other kinds of wholes. To understand mergent wholes it is not enough to know how the parts would separately, we must also know the laws of their behaviour when in that way; and the latter is independent of the former. Such nce, according to Broad, is already observable in the inorganic —the knowledge of the properties of elements as such does not one to predict the properties of a compound—but is most striking case of organisms. There appears to be a general tendency for xes of one order to combine with each other under suitable con- to form complexes of a higher order. At each stage there arise with new characteristics, and at every stage there are new possibi- further developments. In comparison with Biological Mechanism, ory of Emergent Vitalism has the advantage that it can dispense e aid of a Deistic supplement.

relation between body and mind is, according to Broad, very in- Mind acts on body in volition, and body acts on mind in sensation.

If the relation is not described as one of interaction, it is mainly bec that word does not express adequately the intimate character of the lation.

Specially interesting is Broad's view of "psychic factors." He f enough evidence in certain abnormal psychical phenomena to dispose in favour of the view that the mind is not a mere epi-phenomenon of body and existentially dependent on it alone, but a compound subst whose constituents are the organism and a "psychic factor" which is itself a mind, but which may combine with a series of organisms to f a successive series of minds. The psychic factor may exist independe of an organism, and may also combine temporarily with a medium s to reproduce the characteristics of some dead man whose body it once animated. On such a view the survival of the *whole* mind of a hu being is, of course, excluded.

On the question of the status and prospects of mind in nature Bro views are not very definite, nor very rosy. Perpetual mental progre neither impossible nor inevitable. The possibility depends on our ge an adequate knowledge and control of life and mind before the comb tion of ignorance on these subjects with knowledge of physics chemistry wrecks the whole social system. "Which of the runners in very interesting race will win, it is impossible to foretell. But physics death have a long start over psychology and life."

[*Perception, Physics and Reality*, Cambridge, 1914;
Scientific Thought, London, 1923;
The Mind and its Place in Nature, London, 1925;
Five Types of Ethical Theory, London, 1930.]

Earl Russell (b. 1872) has described his philosophy as "logical a ism," sometimes also as "neutral monism," as "pluralism," "realism." It is all these, as will be indicated briefly. To some e Russell follows the example of British empiricists and tries to analys complex experience into its elements or "atoms." But he avoids the take made by Locke and his successors when they assumed that a c plex whole is nothing more than the bare sum of its elements an their separate causal efficacies. Russell realises that a configuration lose its causal properties when broken up into its elements. But he m tains that nevertheless it does consist of these elements related in ce ways, and that is why he calls his philosophy "logical atomism." philosophy is not intended to supplant, but only to supplement, the ences by way of rather speculative suggestions about the world as a w And since science and common sense assume the independent reality multiplicity of events, things, etc., and there are no convincing argum to the contrary, Russell feels justified in embracing both "realism" "pluralism." But what is the nature of the real elements of which world is composed? Idealism, which describes them as psychic character, is rejected by Russell, though he admits its possib Materialism is rejected even more decisively, especially in view o present tendency to reduce matter to mere radiation or wave-en He prefers to regard the ultimate stuff of reality as neither mental erial, but "neutral" in respect of these alternatives. But he thinks the whole world is composed of only one kind of stuff, namely events. ce the name of "neutral monism." But this "monism" is not in-istent with "pluralism," for the monism is qualitative whereas the alism is substantival. In other words, although Russell admits only *kind* of stuff, he also admits the existence of a great multiplicity of ts, each minimal event being logically a self-subsistent entity. "The d consists of a number, perhaps finite, perhaps infinite, of entities h have various relations to each other, and perhaps also various quali- Each of these entities may be called an 'event.'" With regard to practical problems of life and its values, Russell disparages the iletic function which philosophy has inherited from theology. ilosophy cannot itself determine the ends of life, but it can free us the tyranny of prejudice and from distortions due to a narrow ."

Knowledge of the External World, London, 1914;
ticism and Logic, London, 1918;
duction to Mathematical Philosophy, London, 1918;
ysis of Mind, London, 1921;
Outline of Philosophy, London, 1927.]

E. McTaggart (1866–1925) was a realist in his epistemology and an ist in his ontology. According to him knowledge is a true belief, and ief is true when it corresponds to a fact, that is, to something that is thing. The relation of correspondence is not a relation of similarity, it cannot be defined further. Existence and reality are indefinable ties. What exists must be real, but what is real need not exist. For nce, qualities and relations are in themselves real without being ent, though the qualities and relations of existent substances may be d existent. McTaggart denied the existence of time, of matter, and nse-data. He held that the universe is spiritual, consisting of selves ged in one or more primary wholes. The whole content of these s consists in their perceptions of themselves and of each other. e perceptions have emotional and volitional qualities. The universe ot been created, for what is created must be in time, and nothing is ne. Moreover, the appearances of design in the universe do not sug- a conscious designer as its only possible cause, since a certain amount der, and a certain direction towards the good, follows from the intrin- ature of existence.

e Dogmas of Religion, London, 1906, 2nd ed., 1930;
Nature of Existence, Cambridge, I., 1921; II., 1927.]

Santayana (b. 1863) is the poet-philosopher of America, though a iard by birth. He is partly a "critical realist," but this does not uately describe his philosophy. He accepts the reality of trans- ent existences. Of these, however, we have no direct apprehension. by "animal faith" that we accept their reality although they are not tly "given" to us. What is given to us consists of certain images, ns, surface appearances, or general characters which we refer to the

transcendent existences. All such images, etc., Santayana ca
“ essences.” All the familiar pictures painted by the senses, all the theor
of science, and all the doctrines of religion belong to the sphere
“ essences.” And they can all be regarded as so many compatible, thou
different, arts of expression of the same transcendent matter. Materiali
is a presupposition of conventional sanity ; religion is a fairy-tale of c
science. “ All is a tale told . . . by a dreamer. . . . Sensations are ra
dreams ; perceptions are dreams sustained and developed at w
sciences are dreams abstracted, controlled, measured, and rende
scrupulously proportional to their occasions. Knowledge accordingly
ways remains a part of imagination in its terms and in its seat ; yet
virtue of its origin and intent it becomes a memorial and a guide to
fortunes of man in nature.” The whole life of reason is generated
controlled by the animal life of man in the bosom of nature. Hun
ideas have expressive, symbolic value : they are “ the inner notes soun
by man’s passions and by his arts ” ; and they become rational partly
their inner harmony, and partly by their adjustment to external facts
possibilities. The human mind being thus essentially poetical, hur
wisdom lies in taking everything good-humouredly, with a grain of
In any case consciousness, according to Santayana, has no pract
effectiveness, being merely an epiphenomenon, a “ sort of ritual sol
nising the chief episodes in the body’s fortunes.” The only good access
to man is the satisfaction to be derived from the sheer exercise of
reason, and in the æsthetic joy that his artistic creations may yield.

[*The Life of Reason*, 5 vols., New York, 1905–6 ;
Winds of Doctrine, New York, 1913 ;
Scepticism and Animal Faith, New York, 1923 ;
Dialogues in Limbo, New York, 1925 ;
Platonism and the Spiritual Life, New York, 1927 ;
The Realm of Essence, New York, 1927.]

General J. C. Smuts (b. 1870) has outlined a philosophy which he
called Holism. By holism he means a tendency to the formation of sy
mic wholes, each of which is more than the bare sum of its compor
parts. A whole is not a mere aggregate of parts but has a certain struc
(or “ form,” as Aristotle said) in virtue of which it has greater potent
ties than a mere aggregate of similar parts could have. Smuts conte
that this tendency to whole-making is traceable in all types of rea
and is the ground of what has been called creative or emergent ev
tion, which is inconsistent with bare mechanism. Modern science, acc
ing to Smuts, furnishes ample evidence in support of holism. Space
time, for instance, are no longer regarded as homogeneous continua,
have been reduced to a curved and warped Space-Time having a def
structure. Matter likewise has been given a precise structure. Chem
treats the different kinds of substances as the results of different st
tural arrangements of atoms and molecules ; and physics treats the at
themselves as varying in character with the different structural arra
ments of protons and electrons in quasi-solar systems. Matter thus
ceived as a system of electric charges is very different from the old i

and its difference from living protoplasm is considerably reduced. ll differs from the atom in its greater complexity of structure and n, and in the greater co-operation of its parts, which are made to n for the whole. The same applies even to a greater extent to ors consisting of multitudinous cells. Just as a " thing " is a synthe- event " in the system of Relativity, so an organism is a synthesised of history, which includes not only its present, but much of its d even its future. The next higher " whole " after organism is In minds, or psychical organs, the central control is marked by usness, and has a creative power of far-reaching character. The known whole is Personality, which is characterised by the greatest 1 and creative power.

world is characterised by both mechanism and free creation. There anism wherever the working parts of an aggregate produce their individually, so that the total effect is merely the sum of their sepfects. In the course of evolution holism, with its creativeness, gains hanism, and at the stages of mind and personality mechanistic exon is hopelessly inadequate. But mind, and even life, must not be t of as new agents. Life, and mind, and personality must rather be ed as successive advances in the " holistic " structure of matter, ng no disturbance in the prior structure on which each, in turn, l, each being a creative continuation of the old, not a denial of it. inner trend of the universe is directed away from the merely ical towards the holistic type as its immanent ideal. The *summum* of holistic philosophy is free and harmonious self-realisation. The nisus of the universe is regarded as a guarantee that the ideals of eing, of Truth, Beauty and Goodness are firmly rooted in the of things, and are likely to be realised eventually.

and Evolution, London, 1926.]

PRESENT CONCORD BETWEEN SCIENCE, PHILOSOPHY, AND THEOLOGY

foregoing account of recent and contemporary philosophy shows re is considerable vitality in the philosophic thought of the age. ffer may pretend that all these philosophies are little more than iniscences of the thought of past ages. He may take to pieces all ilosophical tapestries and show that they are mainly a patchwork s derived from Heraclitus or Parmenides, Plato or Aristotle, es or Spinoza, Locke or Leibniz, Kant or Hegel, Schelling or hauer. And he may reiterate the oft-repeated charge that there ogress in philosophy. Such disparagement, however, would be nted, even if we admit some of the points on which it professes to l. After all, the whole history of civilisation is so short that it has scribed as a " provincial episode " when measured in terms of al time, to say nothing of cosmic time. And of this " provincial " the whole history of philosophy is but a single aspect, which erged about twenty-five centuries ago, and has been more or less ed more than half the time. Moreover, the problems of philosophy liarly difficult to answer in a manner that may command general

consent. For they do not lend themselves to the kind of empirical ver
cation which secures something like general agreement in the scienc
In fact, as soon as any group of problems becomes amenable to empiri
verification it forsakes its parental, philosophic home, and sets up a
separate science. In this way philosophy always remains the limbo
highly speculative questions, which it is very difficult to answer sat
factorily, but which most intelligent persons find it equally difficult
suppress. And since times do change, and we change with them, ea
age needs at least a restatement of old problems and old solutions
terms best adapted to its own habits of thought or speech. An excess
straining after originality, or the appearance of originality, may do m
harm than good. A knowledge of the history of one's subject is proba
a universal requisite, but especially so in the case of philosophy. For
philosophy it is particularly true that all history is contemporary histo

One of the most interesting features of recent and contempor
philosophy is the renewed co-operation between men of science a
philosophers. During a great part of the nineteenth century scie
and philosophy were scarcely on speaking terms. The estrangement
probably rather harmful to both : science became rather materialis
and philosophy lost something of its realism. The more friendly relati
ship between philosophy and science is therefore to be welcomed.
the change of mind on the part of some men of science is not without
dangers. The pendulum has swung rather hastily from the materiali
to the idealistic extreme. As already suggested, the change is largely
to the new conceptions of matter. The displacement of the old h
impenetrable pebbles by electric charges, or wave radiations, incli
some people to think that matter has lost its materiality and assume
new spirituality. This reminds one rather of a story told by an emin
ecclesiastic about a young lady who, having strayed so far from the pat
virtue as to have a baby, pleaded in mitigation that it was only such a
little baby ! Matter, however refined, is matter still, not mind. Moreo
some eminent physicists, like J. J. Thomson, do not accept the n
substantial view of matter in its entirety.

Next to the new theories of the nature of matter, the now wi
accepted Principle of Indeterminacy has had no little share in conver
certain scientists to a religious view of the world. The principle in q
tion is intimately connected with the new views on matter. It has b
found impossible to determine simultaneously the energy *and* the posi
of a particle. This has been interpreted to mean that electrons or
ticles really have no definite energy and position, both being objecti
indeterminate. From this alleged instance of indeterminacy there
been inferred a general Principle of Indeterminacy (or of Uncertai
according to which, as some would maintain, there is no such thing in
physical world as that causal determination on which the older scien
insisted, and on which the mechanistic philosophy was based. The si
ficance of the Principle of Indeterminacy in relation to free-will
miracles has made a great impression not only on professional the
gians, but also on some scientists, who have consequently shown a
interest in theological thought and phraseology. But the precise mea
and significance of the new principle are still in the melting-pot. Ein

others regard it as a merely temporary " asylum of ignorance," and ct an early restoration of the principles of rigorous causality within lomain of science. In the meantime, the physicist's reliance on abilities concerning the constancy of proportions in which atoms rgo certain changes (like disintegration) in a certain time appears to vidence of physical regularity and determinacy rather than of the of caprice.

ne new scientific speculations, of which but a few examples have been red to here, have culminated in a certain tendency among some tists which can only be described as a kind of mysticism. First ce is described as nothing more than a system of symbols, and even- the whole choir of heaven and furniture of earth seem to fade away a host of bloodless symbols. This whole tendency naturally enough in a kind of ontological idealism, the whole universe being reduced, velled up, to thought pure and simple. Whether all this is explicitly ded is not certain. One and the same scientist may be found to ibe the world, in the same breath almost, as " thought " and as it "—a combination which rather betrays the obscurity of inade- reflection. But in any case the real nature of symbolism does not ir to be sufficiently appreciated. A symbol is always a thing of one which suggests a thing of another kind. Symbolism, it is true, implies ght, since it is only for thought that one kind of thing can suggest or another. But symbolism does not imply the reality of thought only, nless a material thing really is material it cannot serve as a symbol of ing else. The emphasis so often laid on the symbolic character of ce and of nature, though intended perhaps to lay stress on the *signi- e* of things, ends only too frequently in mystification.

e foregoing considerations may help to explain the unusually friendly onship which is loudly proclaimed to exist now between science and hurches. Such an amicable attitude is certainly better for all con- d than was their long-continued antagonism. Yet it is not without its rs. The history of science makes it pretty clear that science was most il when it followed naturalism as its regulative ideal ; and that it ed, or remained immature or barren, when it came under the in- e of theological or mythological conceptions. Let science continue to h its lonely furrow, as indifferent now to the flatteries of the hes as it was erstwhile to their frowns. Galileo and Descartes, and Newton, were deeply religious men (some of them, indeed, superstitiously so), yet they took good care to keep their theology their science, and to carry on their scientific researches on strictly listic lines. Their example deserves to be followed by other men of e, whose theology is probably much more nebulous than was that ir distinguished predecessors. Let it not be forgotten that the le things said by men of science about religion in general may be ted in the defence of dogmas and practices which they do not ap- In this way the representatives of science may actually obstruct the r advance of the Churches along the paths of progress which, under the stimulus of science, they have been following, however , since the days of Bruno, and Galileo, and Servetus. Science owes nderful progress mainly to its specialisation, or division of labour.

It is hardly in keeping with the best traditions of science that its repres
tatives should play the parts of popular philosophers and pontiffs. In
early decades of the nineteenth century, it is true, some of the Fellow
the Royal Society of London did perpetrate a series of Bridgew
Treatises "on the Power, Wisdom and Goodness of God, as manife
in the Creation." Nearly a century has elapsed since then, and pe
still have faith in God and in the Royal Society in spite of those treati
It would be a great pity if that fact served to encourage many of
present Fellows of the Royal Society to tempt Providence too of
Theologians and philosophers certainly have much to learn from scie
Let scientists continue to render the invaluable service of teaching th
by all means—but let them teach science, not philosophy nor theolog

Contemporary philosophy likewise seems to stand in need of an an
gous warning. Considering the fact that so many philosophers were
merly students of theology, the relations between philosophy
theology are naturally expected to be friendly. Among British phil
phers, indeed, the number of defenders of the faith seems to be ab
mally large. It may be that academic conditions, and institutions like
Gifford Trust, either encourage this tendency, or give undue promin
to those who follow it. But philosophy will be in a healthier condi
when it has entirely ceased to be a handmaid to theology, and pur
its cosmic problems as independently as possible of vested interests.

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INTRODUCTION TO ECONOMICS

By

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SYNOPSIS

iomics is most easily defined in terms of the type of question it
; to answer. The difference between different schools of thought,
particularly between the classical economists and modern econo-
s, mainly consists in the different questions they pose and seek to
er. The Physiocrats first tried to represent the economic system
unity, having a rational consistency, and regulated by a system of
ural laws." It was the purpose of Political Economy to discover
laws. In this they played the historical rôle of intellectual cham-
s of the new capitalist order. They were principally concerned
the laws regulating " the circulation of wealth," and by dis-
ing these laws sought to establish practical precepts for the action
vernment in levying taxation and framing commercial and in-
ial legislation. Their most significant contribution was the con-
on of " real cost " and of " surplus." Following them, Adam
h and Ricardo developed the Theory of Value, and elaborated
heory of free competition and *laissez-faire* (or non-interference of
nment in economic affairs). Marx, however, took the basic con-
ons of classical Political Economy, and by enlarging the concept
surplus " into his concept of " surplus-value " used Political
omy as a criticism of the capitalist system.

e second half of the nineteenth century economics, with
s and the Austrian School, acquired its modern form. The
e from the old Political Economy to the new Economics was
cterised by a shift of emphasis from cost and supply to demand
tility as determinants of market value. The new theory is fre-
ly termed the Theory of Marginal Utility. But the change went
r. It represented a concentration on a theory of price, as distinct
the classical concept of " intrinsic value." The theory of price
onceived as a theory of equilibrium ; and a mathematical tech-
was employed. The differences between modern schools of
mists mainly consist in the different ways in which they seek to
this problem of postulating an equilibrium. Certain economists,
ver, such as Marshall, have sought a synthesis between classical

and modern theory, and have based their theory on a subjective, o psychological, conception of utility and of cost. In this way economi has provided a new justification for capitalism, even while an in creasing number of " exceptions " have been admitted to the classic case for *laissez-faire*. But since modern economic theory poses a dif ferent set of questions from classical Political Economy, the former not competent to pass judgment on most of the wider issues wit which the latter was concerned. Particularly does modern economi fail to afford any adequate solution of the so-called Theory of Distr bution. In the Theory of Money modern economists have made im portant progress. Possibly the future will see an increasing ten dency for economists to develop statistical and realistic studies particular concrete problems.

N INTRODUCTION TO ECONOMICS

define what Economics is about is considerably more difficult than t people think. Economic text-books have provided a number of deions. " Economics is a study of man in the ordinary business of life." conomics is a study of those motives and actions which are capable of g measured in money." But such definitions do not carry us very far. nductive and experimental sciences a preliminary definition of scope ven (at least initially) by the nature of the material, although even here frontier may be a vague and fading one : for instance, the frontier been Astronomy and Physics to-day. But since experiment in the social nces is so restricted, Economics is primarily a deductive science, ch (like Geometry and Mechanics) deduces a series of conclusions certain premises or assumptions ; and in a deductive study it is ssarily the development of the concepts themselves which provides its ndaries. In such a case when different schools of thought exist, emring qualitatively different concepts, a satisfactory definition is hardly sible which includes them all. Each may be separately defined, and the relationship in which each stands to the other may be expressed rms of something wider. But a final and satisfactory answer can only y be given when qualitative differences have been reduced to a com term, *viz.*, to common differences of quantity or number. This stage, ever, is far removed as yet in a field so little charted as the social nces ; and for the present the most satisfactory way of defining Econs seems to be in terms of the type of question which it asks and seeks nswer, and similarly to define the rival schools of thought in terms of different questions they pose to themselves or of differences in the of answer they afford. Much of the confusion which reigns in the of Economics to-day is, I believe, due to failure to use this simple ce. Much barren controversy—for instance between the classical omists and modern economists—has been staged with no issue but mate and confusion, because the contestants have failed to realise each is engaged in answering a different set of questions—Ricardo larx, for instance, being concerned with certain aspects of the distion of wealth between classes, Jevons or Pareto with the conditions rice-equilibrium on a competitive market. Much of the discussion as e *adequacy* of a certain theory (say of wages or of profits) turns on her it answers the questions it claims to when those questions are ed with a greater or smaller degree of explicitness. More than one omist has launched his enquiry in quest of answers to certain ques, and then has proceeded to employ an apparatus of assumptions h essentially preclude those questions from receiving any answer.

is the fashionable view to imagine that the early economists were the e craftsmen of economic science who, working with inferior tools and experience, built their structure in an imperfect way, and that thei modern successors have retrieved their errors and mistakes in a mor finished and completer structure. Ricardo is said to have emphasise " only one side " of the problem (*e.g.* supply, not demand) : to have no ticed only one set of the forces at work ; Adam Smith to have laid certai foundations (his enquiry into the causes of the wealth of nations) whic needed the improved technique of a hundred years later to complete Hence the concepts of classical economy are laid against the concepts o twentieth century economic theory and directly compared, to the un doubted credit of the latter for their greater finish and perfection of detai Where they differ (*e.g.* in their emphasis on cost of production as agains utility as determinants of exchange-value), argument is conducted betwee them as though it were solely a question of differences of answers afforde to the same basic *questionnaire.*

This method of approach is fundamentally erroneous. At best it is sufficiently partial view of the matter to cause more confusion than en lightenment ; and any further progress in the subject seems likely to b seriously obstructed until an alternative critical approach is tried. It a commonplace in Art to-day that the " Primitives " of the fourteenth an fifteenth centuries were not merely cruder craftsmen compared to th representational painters of a later date—in many respects they very ob viously were not—but that they were trying to do something that wa qualitatively different. The Physiocrats and the classical economists a in a sense the " Primitives " of economic science. In some ways they ma have had a less finished technique than their twentieth century descend ants. But what is more important is that many of the concepts they use were different and that they were trying to answer a different set of que tions in a different way : questions partly concerned with the distribu tion of income between classes, partly with the conditions of maximu economic progress. This fact is obscured because economists of to-d imagine themselves to be answering, and certainly claim to answer, ma of the questions which their classical forebears set out to do. But, to large extent, I believe that the apparatus which they use produces, reality, solutions which are in fact appropriate to a quite different a more limited context.

THE RISE OF POLITICAL ECONOMY

Political Economy was cradled in those social economic and ide changes which marked the transition in Western Europe to the ne bourgeois epoch. In France and Germany the remnants of feudalism we ripe for abolition. The centre of gravity, economically and politically, w shifting in favour of the *parvenu* " third estate." In England the bou geoisie had come into its own much earlier, and the bourgeois State, pu suing a commercial policy, had been established two to three centuri before. England had had her economic writers at that period—Thom Mun, Locke and Sir William Petty—but they were concerned with d tailed points of State policy rather than with creating a theoretical syste By the end of the eighteenth century a new section of the bourgeois cl was coming into existence : a class of industrial capitalists whose intere

ranged against the existing system established in the combined land-
ng and commercial interests of the eighteenth century Whig aris-
cy. But it was in France rather than England that the unified con-
of an economic society as the subject for Political Economy first
ared. The French Physiocrats of the eighteenth century sketched the
ne which Adam Smith filled out in his enquiry into the *Wealth of*
ons, and Ricardo developed in his analysis of the distribution of
h.

th France and England at this time witnessed a considerable ferment
w ideas, couched in the language of natural science, which since
n and Descartes was making steady conquests. In antithesis to the
uthoritarian order, with its prescribed codes and sanctions, there was
d the concept of a “ natural order,” which showed its hand only when
was unfettered and free, and which gave its sanctions to the popular
In antithesis to authoritarian “ divine right ” was placed the “natural
” of the individual. In was in this framework that there developed
ncept of an economic society. This economic society was still in the
stage, taking shape within the confines of a system of sanctions and
bitions which had at first nurtured and now cramped its further de-
ment as an independent entity. Hence, in opposition to the authori-
views of Mercantilism, which held that a commercial system only
d as such by virtue of detailed regulation by the State and would
se into chaos without such control, Political Economy offered the
ption of an economic order ruled by “ natural law,” which would
y itself ” if left to itself and would only produce the best results if
ral law ” were left to operate free and unfettered. The individual
“ natural right ” to pursue his own self-interest, because in so
by virtue of this “ unseen hand ” he thereby promoted the com-
ood. To discover and postulate this “ natural law ” was the rôle of
al Economy ; and “ the advice to the sovereign ” which it tendered
ot how to regulate, but why not to regulate, economic affairs in
to promote the greatest wealth of the nation. And while the Physio-
oined the slogan *laissez-faire, laissez-aller* (let do as you please, let
you please), the English economists followed Adam Smith in ex-
ing that imposing symmetry of economic harmonies which would
to birth if it were not suffocated and strangled by an unnatural
of obstetrical attention. Political Economy, therefore, had its origin
rived its force as a direct apologetic of capitalist individualism.

economic order ruled by “ natural law ” must possess a unifying
le. However complex and apparently arbitrary the phenomena,
ust be explicable in terms of generalisations which hold together in
stent logical whole. Science is not a matter of classifying everything
rbitrary arrangement of pigeon-holes, or fitting it into a convenient
dexing system, even if this be a necessary preliminary device. Its
e aim is to refer the maze of qualitative differences which meet the
a single common denominator. The Physiocrats were the first
tly to conceive of the economic order in analogy with a natural
m ; and the dominant analogy which presented itself was that
ic society was a system of the circulation of wealth. What was

the physiology of this process ? The economic system was to huma society what the body was to the human personality—the physical bas for the growth of the higher functions ; and the condition of social pr gress was that the economic system should be capable of yielding to t State and the ruling class the largest possible surplus on which the d velopment of the State and of culture could thrive. Quesnay's famo *Tableau Economique* was designed to show how of the annual produ part went by exchange to replace what had been consumed during t previous cycle, another part did not need to go back into the econom system as a condition for restarting a fresh cycle of production and c culation over again, but remained as a *surplus* or *produit net* ; and labo was judged " productive " to the extent that it yielded such a surplu What commerce and manufacture absorbed was what was necessary fuel to their activities. Manufacture exchanged the products which it c not use itself against the agricultural production which it required supply its raw materials and the subsistence of its work-people. Man facture by this act of exchange did no more than give an equivalent equivalent received, and hence was not productive of any surplus. S Mirabeau : " I give a length of cloth to a tailor : he will never be able increase it, so as to make out of it a coat for himself as well as for m Agriculture, on its side, exchanged a part of its products against man factures which it needed for the maintenance of agriculture and the ag cultural population, such as tools and clothing. But this part of its produ which it exchanged against manufactures, *plus* what it used itself subsistence and seed-corn, did not exhaust the whole of the produce the land : a third part went to the landowning class as rent, without exchange of equivalents. This was the essential surplus, or *produit net* the economic system ; and agriculture alone yielded this surplus. Progr consisted in the continual enlargement of this *produit net*.

These ideas have been so often misunderstood by later economi that the Physiocrats are frequently assigned only a modest place in hierarchy of political economy. Economic text-books customarily p them by with a reproof for being so stupid as to assert that agricult alone was " productive," thereby missing the essential definition " productive " as creative of surplus or *produit net*, and missing, too, whole fundamental significance of the distinction between surplus gross produce and cost, as the unifying concept of political econo And in tracing this surplus to agriculture alone the Physiocrats w asserting nothing so silly as their traducers claim : it was a concept b from, and appropriate to, economic society before the French Revo tion, when manufacture on a capitalist basis was still in its infancy land rent was the essential basis of the income of the ruling class. In history of ideology it represents an interesting transitional philoso lying between the old epoch and the new. Formally, by its insistence the importance of agriculture and of land rent, it seemed to rest upon aristocratic society of the past. Certainly it contained no prophecy nineteenth century industrialism or of the needs and functions of a bourgeois class. Indeed, what grounds for such ideas were there eighteenth century France ? But in its implied insistence on remo feudal restrictions on agricultural development and restrictions al investment in farming, in its emphasis on freedom of commerce on land rent as the appropriate basis of taxation, in its concept of a ural " economic order which would " work of itself " unaided by oritarian control, its significance was revolutionary. In the realm of omic ideas, it played the same rôle of John the Baptist to the coming geois revolution that Voltaire and Rousseau played in the realm litical ideas.

am Smith (1723–1790), who was considerably influenced by the iocrats, was much more concerned with composing a commentary ecific economic questions and in advancing a practical thesis than in lishing a conceptual unity. In this he was fully in the tradition of sh empiricism. At the same time, his treatment was more comprehensive in the range of practical issues he touched upon, more thorough detail, and his championing of the new bourgeois philosophy of omic freedom was much more explicit. His enquiry into the causes wealth of nations produced a number of sound empirical generalisa- about the division of labour and the accumulation of capital, a ous criticism of Mercantilism, and an acute analysis of the effects of ent forms of taxation. Temperamentally he differed considerably the Physiocrats, at any rate from Quesnay. His empiricism even had ch of atomism about it. He was at any rate quite willing to be eclectic convenience seemed to demand it. The only considerable point of ine on which he differed from the Physiocrats was in their statement griculture alone was " productive " ; but true to his temperament t the matter there and developed the concept of a *produit net* in facture no further. Ricardo (1772–1823), on the other hand, whose tially continental temperament was in many ways the antithesis of of Adam Smith, was much more in the direct tradition of the ocrats (*i.e.* in the manner of his approach, and in his method, rather n his conclusions). He was concerned to establish a unitary prin- by which to interpret all the major phenomena of the economic n. In particular, he was concerned, like the Physiocrats, with the em of the distribution of wealth. In his treatment *produit net*, or rent, ed specifically the garb of an exaction from the industrious classes e benefit of the passive landowning class. This was an important f perspective. In his theory of Profit he virtually advanced a second s of *produit net*—an implication which Marx was quick to develop— *oduit net* of manufacture. But this species had essential peculiarities, f it belonged to the same broader genus. As it represented the e of the bourgeoisie, the accumulators of industrial capital and the rs of industrial advance, its increase constituted a desirable engine gress, whereas rent, which fed a passive and reactionary aristocracy, tax on progress. Ricardo was *par excellence* the economic prophet of lustrial bourgeoisie.

THE THEORY OF VALUE

Physiocratic analysis clearly turned on the distinction between s and cost and on the notion of equivalence. In Quesnay's circu- process the actual equivalence established on the market in the

exchange of one commodity against another was taken for granted. Bu
such a market equivalence was not a stable thing : cloth did not retain a
invariable value in terms of corn, but changed from year to year, eve
possibly from week to week. What was the secret of such changes ? Wa
there some fundamental, some “ natural ” basis of equivalence whic
market value might not always adequately express ? Was there a sense i
which corn might sell above its value and cloth below it ? If so, might n
a concealed surplus lie behind the act of exchange ?

Such considerations led directly to the search for a theory of valu
which became the primary concern and the essential framework of clas
sical Political Economy. Preoccupied with ideas of “ natural law,” th
political economists came to conceive of a “ natural value,” or principle
economic equivalence, which was not necessarily synonymous wit
actual realised “ market values ” and would only be completely realise
on the market in a “ natural order ”—the ideal *laissez-faire* individuali
system. And since such a value was a principle of “ natural law,”
necessarily had something essentially proper, just and harmonious abo
it. Just as natural science dealt with such properties as “ length ” a
“ weight,” it seemed that economic science ought to be able to base its
on the basic fact of “ value.” “ Intrinsic value ” was commonly di
tinguished from “ extrinsic value ” (or actual exchange-value). Pet
(1623–1687) used the interesting distinction between “ Natural Chea
ness (which) depends upon the few or more hands requisite to produ
the necessities of nature, as corn is cheaper where a man produces co
for 10 than where he can do the like but for 6,” and “ Political Cheapne
(which) depends upon the paucity of the Supernumary Interlopers in
any trade over and above all that are necessary.” Much effort has subs
quently been expended in demonstrating that the classical economis
were confused when they spoke of a “ measure of value,” by which th
sometimes meant the “ cause of value ” and at other times the measuri
rod (be it corn or labour or gold) in which value was expressed. Proba
they did not analyse their concept very deeply ; it is easy in language, a
consequently in thought, to confuse, say, length, or spatial extensi
with the conventional foot, yard and furlong measures. This confusi
however, was not very serious to their reasoning ; and the criticism n
lects what was the essence of their point of view. The thing, the quanti
which constituted the “ intrinsic value,” in so far as it could be separat
abstracted, *ipso facto* constituted an invariable measure of “ value ” t
just as a pound weight constitutes weight, and measures it at the sa
time. But the confusion of which the earlier economists definitely w
guilty was between cost and value. It was distinctly tempting to ident
the two : the distinction between gross produce and net produce turn
on the concept of a cost which consisted in what was “ necessary ”
keep the productive system working—the essential fodder to the e
nomic machine. In each cycle of production a certain amount is put i
the economic system—seed-corn, subsistence for the workers, etc. In
course of the productive cycle enough is yielded to replace this origi
cost or outlay, *plus* something in addition—the *produit net*. So long
this process is conceived in terms of a single composite commodity, co
as it was with Sir William Petty and to some extent with the Physiocr

concept was an easy one. The real cost of a thing consisted in the ay of corn necessary to finance its production, and it was a reason- step to assume that this constituted the " natural value " of a com- ity.[1] But as soon as one included other commodities than corn in cessary " subsistence, the simplicity of the explanation broke down : was involved in the circular problem of first establishing the equiva- e of the various commodities (say corn, meat and cloth) which con- ted cost. To resolve this difficulty, a transition was accordingly made the corn necessary to feed labourers to the actual labour as consti- g the fundamental " cost " and the basis of " natural value." Labour essentially the creative agency in all production, the *sine qua non* of erting what nature offered into the actual requirements of man. The l cost " to mankind of winning a livelihood consisted in the amount bour it was necessary to expend ; and it seemed " natural " that rent commodities should be estimated or valued in proportion to abour their creation required.

it the earlier idea of cost as " subsistence " still remained to sow usion. From the standpoint of an employer and the employing class whole, " cost " in the last analysis consisted in the outlay of subsis- e for workers—the necessary condition of production. What the ers returned to him by their efforts over and above this constituted he employing class the net produce of the system—the source of t on capital. Marx was the first to point out this confusion when he ged Ricardo with confusing labour as the basis of value (the actual titative expenditure of effort) with the wages paid to labourers (the e of their labour-power).[2]

hen Ricardo sought to show that in a " natural order " commodities ed to exchange at their labour equivalents, he did so on the assump- that competition would tend to establish a single level of wages abour of the same quality) and a single level of profits throughout rent lines of production. Since the relative amount of wages ex- ed, say, to produce a yard of cloth and a bushel of corn would be ortional to the labour employed, and since the profit, being the same on capital outlay in the two cases, would be proportional to the y in wages, it followed that the relative values (wages plus profit) of and cloth would be proportional to the labour involved in their pro- on. Summarily, his argument amounted to an identification of y cost and real cost : market prices would be proportional to money (wages), and money costs proportional to labour expended.

is coincidence of normal market value with labour value applied so as fixed capital, embodied in machinery and buildings, bore the ratio to capital laid out as wages in all industries. But this is clearly o : in agriculture or watch-making the ratio of labour to machinery will be relatively high ; in iron or cotton production the ratio will be rel tively low. Ricardo mentioned this as an “ exception ”—in his fi edition as an exception of minor importance, insufficient to invalidate h general principle, in his third edition admitting it as a more serious modi cation of his theory. And a serious modification it certainly was. For, the extent that the ratio between machinery and labour varies, commod ties will actually exchange on the market, not in proportion to the labo expended to produce them (including the stored-up labour embodied the machinery), but some at a higher value and some at a lower. Where relatively large amount of capital is locked up in buildings and plant, t need for this capital to earn a normal rate of profit (otherwise it w eventually migrate elsewhere) will require these commodities to exchan at a higher value against commodities produced with less machiner The coincidence between labour values and market values breaks dow if labour constitutes the fundamental “ real cost,” then the equivalen which the market expresses is not this more fundamental equivalenc Instead, market values = wages *plus* normal rate of profit on the capi employed.

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[1] or this interpretation of classical doctrine and for several other ideas which I am indebted to Mr. P. Sraffa, of Cambridge.

[2] he assertion frequently made that Marx was a man of hasty reading and standing, who based his theories on one or two imperfectly understood of Ricardo, is quite contrary to the fact. One need only read the very de- and acute analysis of the Physiocrats, Smith, Ricardo and several less- economists in Marx's *Theorien über den Mehrwert* (almost unknown in ountry), to realise the absurdity of the assertion.

RICARDO AND RENT OF LAND

But what of rent of land ? Did rent arise because agricultural comm dities exchanged on the market at a higher value, relatively to their labo equivalence, than manufactures ? Did it arise because agricultural valu equalled not only wages *plus* a normal rate of profit on capital employe but wages *plus* profit *plus* rent as well ? In other words, was rent extract because exchange on the market between agriculture and industry caus the former to give less than an equivalent for what it received in e change ? Ricardo formally answered “ No ” to this question by an i genious analytical device. How, indeed, could he admit the inconsisten of a “ natural order ” producing “ unnatural ” exchange equivalent But the answer was entirely dependent on the ingenuity of the devi and not independent of it. This device was the concept of the differe tial, so dear to the economist heart ever since. Rent arose because differences in the fertility of different soils. As the market for corn e panded, the more fertile soils being fully tilled, cultivation extended inferior soils where the expenditure of labour required to produce a bush of corn was greater than on the superior land. The value of corn was dete mined by the labour expended at the margin of cultivation, *i.e.* under t least favourable natural conditions. But since the price of corn in t market equalled the cost on the inferior land, the corn grown on the bet land, where the cost per bushel was less, yielded a surplus. This cons tuted economic rent and accrued to the landowner : directly if he w both owner and cultivator, indirectly through the competition of farme for the better land if the owner leased to a tenant. Rent therefore figur as a product of Nature’s bounty, which the landowning class was able annex as attribute of its right of ownership. And as the progress of socie increased the valuation placed upon these scarce qualities of nature, r sort had to be made to less and less fertile soils, the margin of cultivati was extended, and rent tended to rise. With the march of industrialis s would tend to remain at, or near, subsistence level (owing to the of population and the competition of labourers for employment), the of profit (with the progressive accumulation of capital, fall of price ise in cost of agricultural production) would tend to fall, and at the time rents would tend to rise.

ne exclusion of rent from the problem of market value—excluding it rice-determining element with the dictum, which has sown so much usion, " that rent does not enter into cost of production "—was en- formal. It was a trick of analytical framing, a trick of definition, the lest of tautologies, and nothing more. If price equalled cost at the in, then rent had nothing to do with it, for the simple reason that did not appear at the margin. But it still remained true that, if one of the *average* cost of producing agricultural products, rent arose use a *smaller* quantity of cost-equivalents was yielded by agriculture arket exchange against a given cost equivalent yielded by manufac- In other words, rent arose because the price of corn was raised the *average* cost of producing that corn. But there was this much to id for the Ricardian tautology : the reason for this raised agricultural was the limitation of natural resources and was not the work of able man-made institutions or man-made restrictions. The landlord, wner of scarce natural properties, was a passive not a deliberating t in the process ; and the emergence of rent was consistent with, and violation of, a " natural order " of exchange-, or value-, ratios.

t Ricardo was less concerned with the *qualitative* characteristics nt and profit than with the factors which influenced changes in them, with emphasising the class antagonism which lay between them. And he was most conspicuously champion of the new industrial order. heory of rent as a surplus at the expense of the industrial classes, and on their income, was heavy theoretical artillery against the land- ng interests and against legislation, such as the Corn Laws, which by g rent lowered profit. He was the bourgeois economist *par excellence* use he presented, more explicitly and fully than anyone before him, natural economic order " as a conceptual unity, and presented pro- as essentially consisting in the process of capitalist industrialisation. with him bourgeois Political Economy reached its zenith. His imme- followers did little more than repeat and elaborate his ideas. J. S. (1806–1873), for all his undoubted qualities, was an essentially cau- and unoriginal mind, which played the rôle of careful editor, com- ator and interpreter to Political Economy, rather than an inventor of deas.

AFTER RICARDO

e most significant characteristic of classical Political Economy after do has usually been treated as a marked improvement. Certainly it ved as an attempt to avoid the *impasse* which Ricardo had reached attempt to identify market values with real cost. Viewed in correct ective, I believe, this is to be regarded as a symptom of decline, since nstituted, in effect, an abandonment of the most fundamental part problem which underlay the Physiocratic enquiry and a passing into empiricism and eclecticism. The attempted solution was really

no solution, but a retreat from the issue. It consisted in virtually abandon
ing the conception of objective real cost. “ Real cost ” was retained i
name, but was given an altered content which was sufficient to chang
and to destroy its essential significance. Adam Smith was first responsibl
for importing the phrase “ toil and trouble ” into the problem of rea
cost. But when he referred to labour as the basis of value, he seemed mor
frequently to use it in the original objective sense of concrete materia
expenditure of human energy than in any subjective psychological sense
With Ricardo’s successors and interpreters, the conception of real cos
became explicitly and completely shifted on to a subjective basis. McCul
loch had defined “ real value ” as regulated by the “ quantity of labou
required ” ; but at the same time he seems to have defined Smith’s “ to
and trouble ” as measured by “ the sacrifice to those by whom it [th
labour] is performed.”[1] And after him “ real cost ” became explicitl
something psychological—a disinclination, or *malaise*, in the minc
Given this shift of content, the logical next step was Senior’s “ abstir
ence,” or refraining from present consumption in order to save an
invest, as a second category of real cost, this “ abstinence ” affordin
the “ explanation ” of profit and removing it from the category of
surplus. Real cost = labour + abstinence. Money cost and price =
wages + profit. *Therefore*, market values coincide with real cost. Th
Ricardian dilemma seemed to be solved. But the solution was n
solution. Once the unitary conception of real cost had been abandonec
the possibility of using it as a concept of equivalence between commod
ties necessarily broke down : to enquire whether or not things exchange
in the market on the basis of these equivalents became otiose. One nov
had two dissimilar so-called quantities—“ labour ” and “ abstinence ”-
qualitatively different. How to equate them to form a single quantity
real cost ? Was an hour of labour to be equated to an abstinence from th
enjoyment of £1 for an hour, or for a day, a week or a year ? “ Re
cost ” remained merely as a catalogue-device to embrace two disparat
categories which could only be equated in terms of money—*i.e.* in term
of their market values, which were themselves dependent, of course, o
the market values of the latter. If the former reflected the latter, how coul
they be based on the latter ? What meaning had enquiries about th
identity of the two ? Perhaps a Hedonist psychology (which explaine
human behaviour as motivated by calculations of pleasure and pair
could afford a solution by reducing both “ abstinence ” and “ work ” t
terms of a single quantity—“ Pain.” But this solution, though it was sug
gested, was never very explicitly defined. If it had been, the concept c
sacrifice would probably have had to be shorn of much of the meanin
generally imparted to it. At any rate, it is highly questionable whether an
such solution would find acceptance to-day. As it was, Senior had con
siderable difficulty, I believe an insuperable difficulty, in delimiting h
concept of abstinence. Was there a “ sacrifice,” or “ real cost,” involve
in lending property that was inherited, as well as in lending property th
had been accumulated out of one’s income ? If so, where was the diffe
ence between lending a factory or a railway and lending land ? If not (
Senior decided), why so arbitrary a boundary to the virtues of sacrifice

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[1] J. R. McCulloch : *Principles of Political Economy* (1825), pp. 215-217.

ong as real cost meant “ sacrifice,” there seemed no solution : one
ot sacrifice unless one has something to sacrifice ; and sacrifice
mes simply a “ function ” of available opportunities, variable with
e opportunities and constituting nothing fundamental at all. The
ch for a theory of value became merely an empirical one—a collec-
of the various proximate causes of changes in market price—which
l afford no judgment as to the “ natural ” fitness, appropriateness,
ableness or otherwise of the system of exchange equivalents which
narket established. Moreover, once an adequate system of real cost
gone, there was no basis for any fundamental distinction between
s and net produce : the concept of surplus no longer had a consistent
ing.

MARX AND SURPLUS-VALUE

ne tradition carried down from the Physiocrats through Ricardo
ed not to Ricardo's direct descendants but to Marx (1818–1883),
took the Ricardian system, sheared it of its “ natural law ” frame-
, and revolutionised its qualitative significance. Marx was remarkable
isely for these features of his work, which have most rarely been ap-
ated ; but set against the background of the type of questions which
ical Political Economy was concerned to answer, his system can
y be said to have crowned the classical edifice. Certainly Marx
ned it in a peculiarly Hegelian way : in the manner in which he
ed in his philosophy of history to have turned Hegel upside down—
ve stood him on his feet where he found him standing on his head
ubstituting a materialistic interpretation of history for an idealistic

rx did not start from the concept of natural order underlying the
list system ; for him capitalism did not constitute the final term
onomic progress, but was historically relative and transitional.
e he was biassed by no desire to identify market prices with real
Labour in an objective sense—the expenditure of human energy
uscle or nerve—constituted value, that is the social valuation to be
d on the commodities which were the fruit of this labour. It was the
mental equivalent, the criterion by which one could judge the signi-
e of the price relationships established by the market under vary-
ts of conditions. Without it there was no ultimate criterion. One
not say whether a certain act of exchange represented a passing of
alents or not ; and hence without it the Physiocratic concept of
plus,” as something which accrued without any equivalent being
ed in return, would have no meaning. Under certain sets of con-
s,[1] market prices would coincide with values. Exchange would be
ivalent for equivalent ; but by no means under all sets of conditions.
recisely in the failure to appreciate this that the monstrous misap-
nsions which affected nearly all Marx's subsequent critics consist.
never identified market value with labour value, as Ricardo tried to
ow then could there be a “ Great Contradiction ” when Marx, in
ii. of *Capital*, developing what Ricardo had admitted as an

. what Marx, a little obscurely, termed “ a society of simple commodity
tion ” in vol. i. of *Capital*.

“ exception,” specifically stated that under conditions of modern capit
ism commodities did not exchange at their values, but at what he call
their “ price of production ? ” This latter quantity equalled wages *plu*
normal rate of profit on the capital employed, and diverged from “ valu
to the extent that the ratio of machinery to labour—what he term
the “ organic composition of capital ”—varied in different lines
industry.

Marx’s problem was to determine the distinguishing characterist
the social significance, of capitalist profit. If it was a surplus in the Phys
cratic sense of values paid to someone without a giving of equivalents
exchange, how did it arise and on what conditions did its emerger
depend ? His method was to take a “ simple commodity society,” wh
commodities exchanged at their values (avoiding the complication
different compositions of capital), and to enquire how a surplus co
arise on such assumptions. It could not arise in the course of exchan
because this was an exchange of equivalents. The answer he gave was t
it arose from the peculiarity of labour-power as a commodity in produ
ing more commodities than were used up to produce the original labo
power—used up in the subsistence necessary to replace the energy
pended. Labour-power produced a value greater than its own value. T
capitalist purchased labour at its value ; and this constituted for him
primary expense of production. The value of labour-power was itself
termined by the amount of labour required to produce it—that is,
the subsistence necessary to maintain the worker in working efficier
under any given set of social conditions and at any given time. T
capitalist was able to annex, as his profit, the difference between t
(*viz.*, wages) and the gross value which labour, when set to work, p
duced. Wages were the payment of equivalent for equivalent—subsi
ence for the worker replacing the energy he expended in his employe
service. Profit, in contrast, arose from the peculiar quality of the comm
dity labour-power that, when put to use, this labour created a va
greater than its own value—profit arose from an exploitation of the diff
ence between the value of labour and its product. Hence its qualitat
peculiarity, which he characterised by the term “ surplus value ” ; her
a class antagonism between receivers of surplus value and the produc
of it, which in our own day is more significant than Ricardo’s antagoni
between landlord and capitalist.

But labour-power only figured as a commodity, bought and sold i
labour market, under a definite set of historical conditions—when h
torical processes had created a propertyless proletariat without ot
means of livelihood, on the one hand, and a propertied class on the ot
hand. The emergence of profit, therefore, was not a “ natural ” categ
rooted in a natural order of things : it was a category of income pecul
to a particular stage of historical institutions, to a particular form of cl
society.

In the later stages of his analysis Marx introduced the conditions wh
caused market prices to diverge from value-equivalents. Chief of th
was the need imposed by the competition of capitals for profit to be spre
out so as to yield an equal rate per £, as water finds a common level giv
a sufficiency of connecting pipes. This caused commodities, which h

produced with a relatively large proportion of fixed capital to labour,
ll above their value-equivalent, and commodities which had been
uced with a relatively small proportion of fixed capital to labour, to
elow their value-equivalent. But this divergence was not of a kind
validate his central theorem—to upset the character of profit as
us-value. It effected an altered distribution of this surplus between
ent lines of industry and altered proportions of production in
ent lines ; but it did not affect the size of surplus-value in the mass.

THE NEW ECONOMICS

the last three decades of the nineteenth century Political Economy
rwent an important change, which has a different and a deeper signi-
ce than is customarily realised. Simultaneously and independently
o-called Austrian School, on the one hand, with Menger, Boehm-
rk and Wieser as its giants, and Jevons in England, were building
ew frame-work within which Economics (to use Jevons' new term)
noved ever since. Closely on their heels followed Marshall in this
try and Walras and Pareto, of the so-called Lausanne School, on the
inent.

first sight the change seems mainly a formal one. The new school of
ght has frequently been referred to as the school of Marginal Utility
scribe the two most important features of the new theories. The first
eable difference between the old economists and the new consisted
important shift of emphasis from supply and cost to consumers'
nd and utility as the determinants of exchange-value. Value was no
r regarded as determined by labour, or even by labour *plus* abstin-
but by the capacity of a commodity to afford satisfaction to con-
rs (*i.e.*, its utility). This represented a psychological and Hedonist
ach to the problem from the standpoint of consumers' desires. The
d feature of the new theories was their emphasis on the effect of
es at the *margin*—for instance, the loss or gain of utility resulting
“ a little less ” or “ a little more ” of a certain commodity (say, cloth
n or tea) ; and it was the utility of “ a little less ” or “ a little more ”
arginal utility) which was regarded as important in the determina-
f value. This emphasis on the margin was the result of an attempt to
uct economic science in a mathematical framework. Jevons (1835–
, for instance, was at considerable pains to prove that economics
be a mathematical science in *form*, whether the economist actually
in words or in algebraic symbols. He accordingly employed the
matical conceptions of the differential calculus and of functional
ons as a convenient analytical technique ; and since the differential
us deals in terms of small increments and decrements (of “ a little
” or “ a little less ” of something or other), economists tended to
their theories in terms of marginal changes of this kind.

the change went deeper than this : it was a change of concep-
pproach, and a change in the type of question that was being
red. The new economists were not concerned primarily with con-
ns of “ real cost ” and “ surplus ” ; they were not concerned with a
ple of intrinsic value as a key to the problem of equivalence. They
oncerned with a more empirical enquiry—the causes of changes in

market values. This enquiry bounded their horizon so far as the theo retical core of economics was concerned ; and all the major econom problems could be reduced to these terms. It was natural that, in pursu of such an enquiry, the analogy of a theory of equilibrium should b suggested from mechanics. " Value " represented a certain " position or " level " which, in equilibrium, a commodity occupied relatively the remainder of commodities. In this sense " value " was always a " rel tive " value ; and the concept of " absolute value " as a sort of " fix star " in the economic universe was meaningless. The purpose of ec nomic theory was to postulate the series of equilibria which would resu under various possible sets of conditions ; just as a theory of mechani enables one to calculate that, given a collection of forces at work in certain arrangement, things will come to rest in a certain equilibriu position. But, as everyone knows who has ever played with a collection pulleys or thought about the structure of a suspension bridge, it may n always be possible to calculate a " stable equilibrium " where opposi strains and stresses balance one another ; while in certain very comp cated situations one may not know enough of the facts to be able calculate what the new equilibrium will be, if one starts a movement displacing one of the forces at work. To be able to calculate an equi brium, therefore, the situation one is dealing with and one's knowled about it must fulfil certain conditions. Whether these conditions a fulfilled or not is the criterion by which one judges whether a theory equilibrium in economics, as in mechanics, is *adequate* or not.

The attempt to calculate an equilibrium in a given situation is com parable to the familiar attempt in algebra to " solve " a system of simu taneous equations. In these equations there are a number of " unknov variables " (usually written as x, y, z, etc.) and a number of " constants (usually written as a, b, c, etc.). About the former, it is assumed, o knows initially nothing at all. The latter are part of the given *data* of t problem : some particular value, or number, is, or can be, assigned them ; and the actual arithmetical " solution " of the equations will dif according to the value assignable to these " constants." The " solution consists in " determining " (or finding the value of) the unknowns (t x, y, z, etc.). A simple rule exists as to whether a system of equations capable of being solved : it has a solution if *the number of equations known relationships) is equal to the number of unknown variables which ha to be determined*. And this is the criterion of whether a theory of equi brium is " adequate " or not.

Economic theory has employed the conception of " functional equ tions " (one quantity is expressed as a " function " of another if the o varies, or moves, with the other in some particular way). Moreover, it h employed functional equations of an " arbitrary " or general type, whi merely postulate *some* functional relationship between quantities, and r any *one particular* relationship. By this means it has made its conclusio of a more general character—a given theory is made to cover a wid range of possible cases. For instance, economic theory may assume t consumers' demand for " a little more " of x will decrease with the qua tity of it that is offered for sale, but without specifying the precise natu of that variation of demand ; and in this way x can be taken to repres

der range of particular cases (*e.g.*, corn or cloth or tea or gramo-
es or labour).

the new economics, therefore, it was no longer a question of search-
or a single " cause " of value, a primary constituent or principle to
h all questions of exchange and distribution could be related. There
no longer a need (at any rate for the theory of value as now conceived)
alyse everything into terms of what was virtually a single factor of
uction—a common term of real cost in relation to which qualitative
ences could be resolved. It was a question of grouping together cer-
functional relationships, all of which, in combination and " simul-
usly," determined value. It was a matter of pure convenience how
factors of production there were, provided only one could make
ient assumptions about the supply of them. All that was necessary
o be able to postulate a sufficient number of conditions and to find
ight number of independent variables for a determinate equilibrium
established. In the search for these independent factors Jevons and
Austrians transferred their attention from conditions of production
nsumption, from supply to demand, and sought the important de-
ining factor in what underlay consumers' demand. And here Hedon-
gave them an important clue. Consumers' demand was a reflection
nsumers' desire ; and desire, in turn, (at least in rational men) was
d in the pleasure which the object of desire afforded. This capa-
of affording pleasure Jevons termed Utility. The earlier economists
indicated that value could not be a function of utility, since some
nodities, like water, had a high utility but little or no value, and
s, like diamonds, had small utility but high value ; and Marx had
ed out that utility was not a quantity and could not therefore bear a
on to a quantity value. The discovery which Jevons and the Aus-
claimed to enunciate was that price was a function, not of aggregate
(which it obviously could not be), but of the *increment of utility*—
additional utility afforded to the consumer by the marginal unit of
n supply.

r instance, of a given supply of fish offered for sale on a market on a
ular day the marginal utility of the supply of fish would be the
to some consumer or other of the *n*th or final lot of fish sold. (By
meant, that, if there are 100 fish, it is the hundredth ; if 1,000 fish,
ousandth, and so on.) Price could not be greater than this (if the fish
rketed at a single price), otherwise the final lot of fish would not find
chaser who thought it worth while (as measured by its utility) to buy
fish at this price ; while on the other hand the seller of fish, desir-
get the highest price he could, would presumably not part with his
a price appreciably below this. Whether utility itself was a quantity
t, this marginal increment of it was capable of being expressed in
itative form. Jevons said : " Repeated reflection and enquiry has led
the somewhat novel opinion that value depends entirely upon
. . . . Labour is found often to determine value, but only in an in-
manner by varying the degree of utility of the commodity through
rease or limitation of the supply.[1]

starting-point of the new theory was an empirical observation about the nature of desires, which has been variously described as Law of Diminishing Utility or the Law of Satiety of Wants. The uti of a thing would generally increase with the amount of it possessed enjoyed, but generally at a diminishing rate, the increment of uti afforded by an increment of supply tending towards zero at some r or distant point—the point of satiety. It was this increment of utilit any one point—" the final degree of utility," as Jevons called it, " marginal utility," as Marshall termed it—which determined va since this fixed the worth of a little more, or a little less, of the thing to person in question, and so determined the rate at which he was wil to exchange it against something else—against money or other co modities. For instance, suppose two persons A and B exchanging c against cloth. One could express the utility of corn and of cloth to e of the parties as some function of the respective quantities of corn cloth possessed. The seller of corn will find it in his interest to conti to give corn in exchange for cloth up to the point where the utility of bushel of corn he is parting with is equal to that of the quantity of cl he obtains in return; and similarly for the other party. Hence the posi of equilibrium—the point where exchange between them will stop—wil that rate of exchange where the marginal utility of corn and cloth is ec for each of the two parties. Hence, given this condition and the form the utility function for the two parties, a determinate equilibrium— amount of corn and cloth exchanged—can be calculated. Expressed sy bolically in terms of two commodities *a* and *b*, we have the following c ditions of equilibrium :—

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[1] W. S. Jevons : *Theory of Political Economy*, (1871), pp. 1–2.

$$\frac{\phi_1 (x_1)}{\psi_1 (y_1)} = \frac{x}{y} = \frac{\phi_2 (x_2)}{\psi_2 (y_2)}$$

where $\phi_1 (x_1)$ and $\psi_1 (y_1)$ represent the utility-functions of *a* and *b* tc and $\phi_2 (x_2)$ and $\psi_2 (y_2)$ the utility-functions of *a* and *b* to B. In graph form the relation between the pair of utility-functions to A can be pressed as a curve, and similarly for B ; and the equilibrium will represented as the point of intersection of the curves.

In this problem there are two equations and two unknowns, so that equations yield a determinate solution.[1] Some economists have b quick to point out, as a corollary of this reasoning, that this equilibriu rate of exchange, which the conditions of a free market tend to establ is that which gives the maximum common gain of utility to the pers concerned in the exchange—in other words, that which coincides v what is socially desirable from a Hedonist point of view. Any in ference with a free market and the prices which it tends to establish accordingly reduce, and not augment, this common gain.

Prices are viewed simply as the resultant of subjective valuations in minds of the individuals concerned. Expressed in the simple form of commodities being bartered against one another, the problem does give much room for dispute ; and in the manner of treatment of the sir lest case the underlying unity of modern economics is typified. But w lepart from this abstract case and approach nearer to the conditions e economic world, where exchange is generally not between owners of ks of two commodities but between producers and consumers, and re the buyer is concerned not with one isolated transaction but with a itude of related transactions, a number of complications arise ; and it their different handling of these complications that the differences ben schools of economists subsequent to Jevons mainly consisted. To nsiderable extent, therefore, the differences between these schools is ly formal.

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[1] This was the view of Jevons. It has since been established that under di barter the conditions do not suffice to give a single solution.

SUBJECTIVE "REAL COST"

ne first set of complications arises when allowance is made for the that in the modern commercial world the goods which he sells have irect utility to the seller : they are " worth " to him merely what they cost. His willingness to sell is a function, not of their utility to him n our corn and cloth example), but of their cost. An analysis of cost erefore required. Here it would seem that economists had returned to sue which principally exercised their classical forebears. The cost of a ned commodity consists of the price paid to the factors of production ired to produce it. The problem becomes one of determining the of the factors of production, land, labour and capital. Much conn indeed has been caused by the habit of economists of labelling part of their enquiry " Distribution," and imagining that here they adequately answering the same questions as the Physiocrats and rdo were doing. Actually the issue was, in large part, a different one. classical question was mainly one of the *share* (of the total produce) ing to different social classes and the contrasting characteristics of shares. The new question was simply one of the market price per of the constituent commodities which entered into the creation of ned commodities. The factors of production, whether they were ed as three in number or twenty, were simply these constituent comties ; and for the purpose of this enquiry they were differentiated g themselves by no more fundamental characteristics than those n marked the x's and y's of our cloth and corn example. To enquire their value was simply to add certain additional variables to the set nultaneous equations, requiring the addition of a similar number of equations to complete a solution. They were part of the conditions multaneous equilibrium of finished and intermediate (or instrual) commodities.

e Austrians adopted a simple condition in order to solve this prob-They assumed the quantity of the agents of production to be indeently determined. By " independent," for this purpose, they meant hanges in the supply of them did not depend on the price of these s or of commodities, or on any other of the variables directly ind in the problem. Hence the supply of land, labour and capital be treated for any one problem as fixed : they could figure in the ions as " constants." The problem had then a simple solution : the of each factor could then be expressed simply as a function of the of the commodities which it produced. This is the famous " Theory of Marginal Productivity." Given the supply of, say, labour, the supply labour will tend to be distributed between various sorts of production, that the value of an increment of product yielded by an increment labour (its marginal productivity) in all uses is equal ; and the value of t increment which the final or marginal unit of labour is responsible for ac ing to the total produce determines the value of this factor of producti There are, then, *n* additional unknowns in the problem (the price the *n* factors of production) and *n* additional functional equations.

Walras, and later Cassel, introduced in addition the conception of "technical coefficients." The production of different commodities v require the factors of production to be combined in different proportio corn production will require more land relatively to capital than will production of cloth. The "technical coefficients" for commodity *x* c be expressed by a series representing the quantities of the different fact required to produce a unit of *x*. The weighted average for all commodit (*x*, *y*, *z*) will then give the "technical coefficients" for the econor system in general. Every change in technique will change these "te nical coefficients" in particular industries and in industry in genera for instance a new invention which increases the proportion of mecha ical power to human labour in some industry or group of industrie and these changes will affect both the prices of commodities and the re tive prices of the factors of production.

Jevons, on the other hand, did not make this simplifying assumpt concerning the supply of the factors of production, except in the case land. The supply of labour, for instance, was likely to change with chan in wages, according as a higher wage gave a greater inducement to w harder and longer. The supply of labour, therefore, constituted an ad tional unknown quantity to determine. Here Jevons consistently appl the same Hedonist concept as he had applied to the problem of dema As demand could be expressed as a function of "pleasure" or "utilit so the supply of labour could be expressed as a function of the "pai or "disutility," involved in work. Not the supply of labour itself, but disutility-function of work, was for him the independent constant which the problem was resolved. "Labour," he wrote, "will be carr on until the increase of utility from any of the employments just balan the increase of pain. This amounts to saying that . . . the increase utility derived from the first employment of labour is equal in amount feeling to . . . the increase of labour by which it is obtained."[1]

This method of handling the problem was extended by Marshall, a with him it became the basis for an attempt to redress the classical co ception of "surplus," and to effect a synthesis between the modern a the classical school. We have already noticed that it was never perfec clear whether the early economists, when they referred to "real cos conceived of it in an objective or in a subjective sense. In the main seems to have had the significance for them of some objective quant "used up," *e.g.*, corn or the expenditure of physical energy. But alrea with Smith and McCulloch there were signs of a shifting of the idea t purely subjective content. With Senior the identification of "real cos with "sacrifice" was explicit. Jevons' "disutility" and Marsha orts and sacrifices" were in the direct line of descent from this; and them the exclusively psychological content of the idea was made dantly clear. "Sacrifice" was measured, not in any objective tity, but by the pain or aversion aroused in the mind of the person nsible for this effort or abstinence. For Marshall the labour of the er and the saving of the investor and the risk-taking of the *entreur* (the "undertaker" of the risks of a business) all involved such a l cost." To persuade the worker to work, the investor to save, the *preneur* to be enterprising, a reward equivalent to the sacrifice—a y to balance the disutility—was necessary; and this necessary re-, required to evoke various quantities of labour, capital and enter-, could be represented as a supply-function or as a schedule of ly-prices. Marshall said: "The exertion of all the different kinds of ur that are directly or indirectly involved in making it, together with bstinences, or rather the waitings, required for saving the capital used aking it: all these efforts and sacrifices together will be called the *cost of production* of the commodity. The sum of money that has to be for these efforts and sacrifices will be called either its money cost oduction or its expenses of production; they are the prices which to be paid in order to call forth an adequate supply of the efforts and ngs that are required for making it: or, in other words, they are its ly-price."[1] The identification of price with "real cost," be it noted, only at the margin; and hence the reward of a factor (representing the *inal* disutility involved in it) would tend to be in excess of the *average* ility involved. This difference between the sacrifice and reward con-ted various species of producers' surplus—a surplus of utility over ility—which was simply another facet of the so-called consumers' us which a consumer enjoyed from the difference between the inal utility and total utility—the difference between what he pays and he gets.

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[1] *Theory of Political Economy*, p. 185.

arshall and his school have sometimes been termed the neo-cists, in contrast to the Austrians and certain of their American fol-s, such as J. B. Clark and T. N. Carver, who explicitly cut them- adrift from the earlier Political Economy. The grounds for the consist in his attempt to preserve the classical conceptions of real nd of rent. Rent of land, in Marshall's treatment, remained qualita- distinct from the rewards of other factors of production, for the n that the supply of land was fixed, independent of human action, hat no "real cost"—no "effort or sacrifice"—was involved in the y of it. It followed, as an important corollary, that economic rent be taxed, or otherwise removed, without making the supply of land he less; whereas to tax wages or interest, by reducing the reward the necessary supply-price of working and saving, would cause a kage of supply of these factors of production. Marshall was careful, ver, to soften the rigidity of the Ricardian distinction. Rent of land red to him "not as a thing by itself but as a leading species of a genus": elements of "producers' surplus" appeared in incomes d by other factors of production; and, in particular, capital sunk in ings and plant bore all the characteristics of land for the period of durability of such capital (for which reason he coined the term *qua* *rent* to designate a short-period view of the return on capital that immobilised in fixed forms).

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[1] *Principles of Economics*, (1890), p. 339.

In the treatment adopted by the Austrians, on the other hand, a still more clearly in the case of Cassel, the basis for any such distincti entirely disappears : all returns are equally " surpluses " or equal " necessary expenses." The distinction becomes meaningless, since hypothesis all the factors of production stand on the same footing. T supply of all of them is assumed to be given : no question of a functio relationship between the supply of them and their reward enters Explicitly, such writers have declared that the only cost is the loss of t utilities which a factor could have produced if applied in a *different* from that to which it is actually applied. Cost is simply the other " s of the shield " from utility : it simply consists of utilities of which one deprived by adopting a certain course of action. The American economi Davenport has analysed all cost as " opportunity cost." Cassel speaks the " scarcity-principle " as underlying equally the return to all the fa tors of production ; while in England Wicksteed devoted considera space to enunciating his thesis that the Ricardian theory of rent w only a special case of the general Theory of Marginal Productivity, a that what could be argued concerning land was equally capable of bei argued, on the same assumptions, concerning any of the other factors production.

GENERAL AND PARTICULAR EQUILIBRIUM

The second set of complications arises when from the simplified ca of exchange between two commodities, say cloth and corn, we pass to more complex considerations of equilibrium in the real world, whe purchase and sale of a large range of commodities are continually taki place. In considering the price of any particular commodity, say co one must consider it as being exchanged against the whole mass other commodities or against generalised purchasing power, or mon (The two things come to the same thing, since money has no utili of its own apart from that of the things it can purchase.) Hence t buyers' demand for corn (whether measured in terms of money or commodities in general) must be expressed as a function not only of t utility of corn, but also of the marginal utility of all other commoditi Any change in the supply, and hence in the marginal utility and pri of any of these other commodities will therefore alter this demand-fun tion. The so-called Lausanne School, represented by Walras and Pare have accordingly occupied themselves with this more complex probl of *general equilibrium*, attempting to establish the terms of equilibrium all commodities by means of a system of simultaneous equations to co the aggregate of commodities. English and American economists, on t other hand, have in general confined their analysis to the problem o particular commodity treated in isolation. To make this possible, t assumption is necessary that the price of all other commodities (and hen the marginal utility of money to buyers) is constant ; and this requi the further assumption that the commodity in question is so small a p e buyers' total expenditure that a change in *its* price exerts no appre- le influence on the price of other commodities (by affecting the demand hem) or on the marginal utility of money to buyers. Such a reac- is regarded as being so small as to be negligible (what mathematicians of " the second order of small quantities "). A similar assumption has e made on the side of supply. It has to be assumed that a change in output of this particular commodity (say, silk stockings) does not eciably affect the demand for the factors of production (land, labour, al) and hence does not alter the price of these latter. This assump- will be valid if the production of the commodity in question occupies a small part of the factors of production in the community at large. n, however, a commodity such as corn is being considered, which s large both in the average consumers' expenditure and in the em- ment of one or more of the factors of production, this convenient mption breaks down, and a solution is only possible by the more plex methods of the Lausanne School.

ECONOMICS AS AN APOLOGETIC

s we have mentioned, the exponents of the utility theory have com- ly underlined a significant corollary of their theory. They have ted out that the competitive equilibrium which their equations estab- represents the system of prices which yields the greatest common (of utility) to all the parties concerned. This can be demonstrated to w as a direct corollary from the cloth and corn example which was above. If the seller of cloth, for instance, stopped his exchange of for corn before the equilibrium (or " normal ") rate of exchange reached, he would be getting a smaller total utility than he might wise have done ; for the marginal utility of the cloth he possessed d be less than the utility of the corn he *might* have got had he con- d the act of exchange further. This will continue to be true up to oint where the utility of the marginal cloth he parts with is equal to tility of the corn he gets in exchange. And similarly for the seller of Again, it can be easily demonstrated that the distribution of the rs of production between their various uses in such a way as to ise their marginal yield is the condition of their maximum produc- . This follows for the reason that, if the marginal unit of labour oyed in cultivating, say, potatoes is producing more than the mar- unit of labour employed in cultivating carrots, there will clearly be in shifting labour from carrots to potatoes—a gain which will only when labour is so distributed between potato-culture and carrot- re that the marginal productivity of labour in both directions is . Hence, any interference with competitive equilibrium, and with rices which competition tends to establish, is likely to decrease, than to increase, economic welfare.

ch conclusions were clearly of very considerable significance ; and ms evident that to establish these important conclusions was the ry concern of the earlier utility theorists. By the middle of the nine- h century industrial capitalism had won its battle against the old y. There was no longer much need, at least in England, for a cudgel

against the dominance of the landed interest ; while America, having
feudal past to hamper it, was born bourgeois from the colonial days. N
was there any longer the same need to create economic society as a co
ceptual unity in antithesis to the old authoritarian sanctions. Men w
no longer interested in precisely those solutions which were the conc
of bourgeois economists a hundred years before. Moreover, the tool wh
Ricardo had fashioned had been subsequently turned to dangerous u
in the hands of Marx. The new subjective economics, therefore, serve
double purpose. It provided a new justification of the bourgeois ord
and one more convincing to an age grown sceptical of the " unseen han
of " natural law." At the same time, as an analysis of market price it p
vided a technique better suited to the more detailed, more microsco
problems with which the economic system in its maturity increasin
engrossed the minds of its servants.

Actually this imposing apology of *laissez-faire* is hardly more than
clever sleight-of-hand. The corollary follows simply because the nec
sary conditions to support the corollary are included in the assumptio
from which one starts. And since these conditions are implicit in
assumptions, rather than explicit, the corollary can be produced in th
atmosphere of surprise which (along with his " patter ") is so commo
the conjuror's most valuable stock-in-trade. If two persons are equa
situated, they will, by hypothesis, continue to perform the act of exchan
with one another until it does not profit them to continue the transact
further ; and therefore it follows that their common gain would
smaller if they carried on their transactions either further than or not
far as this point. On the other hand, if the two parties are unequally si
ated, there is nothing to say that the outcome of free exchange betwe
them would not represent a smaller gain than if they had been less u
equally situated, or to say that *laissez-faire* will do anything but perpetu
this inferior state of affairs. Again, Professor J. B. Clark may assure
that he can convincingly demonstrate (by the Theory of Marginal P
ductivity) that " a natural law exists " which causes " free competiti
(to tend) to give to labour what labour creates, to capital what capi
creates and to *entrepreneurs* what the co-ordinating function creates "
but the fact remains that if society were not a class society, wh
" labour " is provided by a proletarian class possessing no land or capit
the " creation " attributable to labour and the " creation " attributa
to capital would be considerably different from what they are. Here,
particular, the demonstration of an " economic harmony " is a m
trick of words.

Increasingly, indeed, to-day economists are stressing " exception
to this supposed harmony of *laissez-faire* ; even while they still custo
arily admit *laissez-faire* as a " general principle." Marshall himself w
particularly careful to fence his analysis with a careful regard for
" exceptions " and modifications which special conditions (ignored
the more abstract formulation of theory) imposed. And Professor Pig
developing certain hints of Marshall, has (in his *Economics of Welfa*
turned a powerful battery against the *laissez-faire* position, stressing
inadequacy of *laissez-faire* to achieve the *optimum* result in the case

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[1] *Distribution of Wealth* (1899), p. 3.

ıstries subject to "increasing returns" (or decreasing cost) as the : of production is expanded and in the case of various social costs and ıl utilities which do not figure in the economic calculations of individ ls. At any rate, with the competitive capitalism of the nineteenth ury passing increasingly into the monopolist capitalism of the twen . century, discussions of the value of competitive equilibrium retain : more than their academic interest; and the increasing need of the capitalist forms for systems and methods of economic control, ther by the State, public corporations, or trade associations, has ered the vindication of *laissez-faire* largely otiose.

is, however, in the realm which economists term "the Theory of ribution" that the modern proletarian challenge to capitalism has ıly come; and here economic theory is still successful as an apolo :. Not all economists may be so daring in their verbal agility as Pro ɪr Clark. Few to-day would join him in explicitly enunciating that the ibution of income is governed by "the hidden hand" of "natural " Yet the theory that the returns to labour and capital correspond ıe "effort and sacrifice" involved is a definite bulwark against xist criticism. Interest and profit, as well as wages, are the "neces " rewards for an essential economic contribution; and without the rd the contribution would not be forthcoming. True, rent re ıs as a surplus, a deduction from producers for the enrichment of a ve class. But pure economic rent to-day, when land has been im ed by decades of capital investment, represents only a relatively small on even of the return to land, while "surplus" elements are also d in other incomes, including wages. Marshall's theory of "normal t" was clearly fashioned to demonstrate that, from a long-period lpoint, profit contains no surplus, no "non-necessary" element; : Cassel is at pains to demonstrate, by the "scarcity principle," that est would still exist in a socialist State.[1] Welfare may be augmented y measures which reduce the inequality of incomes; certain surplus ents in income may be desirably appropriated by the community ıe common good. Still, economic theory postulates various limits to remedial action in the connection which exists between incomes and ıpply of necessary services. At any rate, even in the treatment of the ɪr by J. A. Hobson (who has carried Marshall's surplus and supply distinction furthest), there appears no defined class antithesis be ı qualitatively contrasted class-incomes—an antithesis such as ·d in the treatment of Ricardo and Marx, holding the possibility of olutionary change of institutions.

the extent that Economics concerns itself with this type of consi on, it is clearly attempting to answer somewhat similar questions to which the older Political Economy sought to answer. Most notice vith Marshall, we find the attempt to use the new technique and to o a classical framework. Yet we have suggested that it has really set answer not the same but a different set of questions. Is it then com : to answer the former, as well as the latter questions? Or is it ng competence over a sphere from which it is properly debarred by

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[1] *Theory of Social Economy* (1923), vol. i, chapter vi.

the very assumptions which lie implicit in its method of enquir
Clearly, if modern economics is simply a theory of market price and
more, it cannot provide a criterion by which to gauge the significance
any particular arrangement of prices. Being simply a theory of equilibri
—a group of equations showing the relationship between a system
variables—it can do no more than postulate the system of prices approp
ate to a number of possible situations (for instance the prices appropriate
a competitive situation, on the one hand, and to monopoly, on the othe
to a class society and a classless society). It says nothing about the relati
character or significance of these various situations ; and hence it
make none of the *normative* judgments which economics is usually
quired to make, for the simple reason that a mere system of simultane
equations by itself contains no norm (or standard). It was such a no
that the old Political Economy sought to provide in its theory of va
(as distinct from market price). But a mere equilibrium theory, wh
expresses market price as a function of certain variables, cannot its
supply such a norm.

It is in providing such a norm to a simple equilibrium theory that
Hedonist basis of the utility theory has its importance. For a pure the
of equilibrium such a basis is quite unnecessary, as various writers su
as Pareto and later Cassel have indicated. It is sufficient for the the
of price to postulate simply certain *choices*—to take the observed fact
certain scale of preferences among consumers as between different goo
Nothing need be assumed concerning the *significance* of these preferen
—whether the market's preference for cocaine, quack-medicines
diamonds is because they yield more satisfaction or welfare than opera
working-class houses. Given one set of preferences, there will be a set
prices appropriate to them ; to another set of preferences another
of prices. There is nothing postulated about the value of the first set
preferences against the second. This may be very convenient so far
mere equilibrium theory goes—more economical in its hypotheses.
the same time, without these further inconvenient assumptions o
scope is strictly limited. One cannot say that an economic system wh
adjusts production so as to satisfy those preferences to the full is
more economically desirable than a system which deliberately igno
those preferences and establishes a set of prices appropriate to someth
quite different. If, however, one assumes that the demand for goods wh
is expressed by consumers on the market is a true index of some fun
mental satisfaction (the old sense of utility) which they derive from th
goods, then one can postulate the conditions under which this satisfact
will be maximised. A criterion then exists by which, for instance, it
be said that the set of prices appropriate to competitive conditions co
nearer to this *optimum* than that appropriate to monopoly. A criter
exists by which it can be said whether an economic society based on
price system and the market is economically preferable to a commu
society which strictly subordinates the open market and curtails the p
mechanism.

The modern tendency, however, is explicitly to sever this connect
between Economics and Hedonism and to define " utility " in a pu
empirical, behaviourist sense as measured by a person's observed de

commodity. Cassel goes even further, and bases his theory of price
bserved demands on the market *expressed in money*. Price becomes,
efore, on the side of demand a reflection or a product of consumers'
erences, or choices. For the purpose of the equilibrium theory, these
es are taken as ultimate—as the data of the problem. They are
nstants," which in the concrete case give the actual numerical value
e equations. But, in fact, these choices are not necessarily the reflec-
of anything ultimate : they may be arbitrary, ephemeral. They may
ne result of a passing whim, of a convention or the creation of a
ing advertiser. They may, indeed, themselves be partly dependent
rice—for example, the changes of habits and conventional desires
h accompany changes in relative prices or in the general price-level.
assel's treatment, indeed, they are largely a function of the distribu-
of income, not merely through the influence of the distribution
come on conventional standards and desires of different classes,
ecause the distribution of wealth between rich and poor will *directly*
the market preference (as expressed in *money-demand*) for, say, rare
ies as against cheap articles of mass consumption. At any rate, the
y of price endows these market preferences with no other signific-
than as the *data* for a theory of market equilibrium. In any wider
they are entirely non-significant.

me economists, particularly those of the school of Marshall and
s, still attempt to retain the old notion of utility as implying
action of *needs*, and so to make economics into a normative science
onomic welfare—that is, a science which implies *judgments* as well
rely describing things as they exist. Marshall pointed out (though in
ore than a footnote)[1] that *desires* and *satisfactions* may diverge. But
he said, the measurement of satisfaction is impossible, " we fall
on the measurement which economics supplies of the motive or
g force to action : and to make it serve, with all its faults, *both* for
esires which prompt activities and for the satisfactions that result
hem." Following him, Professor Pigou has admitted the possibility
ap " between them : one may " desire " a patent medicine and at
me time acquire a negative amount of lasting satisfaction from it.
has suggested that such a divergence is probably not serious in the
f " most commodities, especially those of wide consumption that
quired as articles of food and clothing." These, being " wanted as
of satisfaction, will consequently be desired with intensities pro-
ned to the satisfaction they are expected to yield."[2] This is probably
f prime necessaries—precisely the basic commodities which a
unist society, for instance, could distribute without any difficulty
tioned system, dispensing with a price system. But as soon as we
om prime necessaries to comforts and semi-luxuries, coincidence
ire and satisfaction seems to become increasingly questionable.
natters of acquired taste a large number of biassing circumstances
kely to play a part in determining the taste that is actually acquired.
seems no warrant for assuming that the choice which ultimately
will necessarily be any more conducive to welfare than an

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[1] *Principles of Economics*, pp. 92-93.

[2] *Economics of Welfare* (1920), p. 25.

alternative taste which might have been nurtured in a slightly altered
of circumstances. Moreover, purely conventional standards—particula
class conventions—enter surprisingly deeply into nearly all our tas
other than the primary needs of the body—a point which Thorst
Veblen illustrated with so much acumen. And these days, when adverti
ment plays the prime rôle in business supremacy, thriving as it does
“ educating the consumer,” afford much temptation to regard consume
preferences as significant of little else than the persuasive skill of
publicity agent, the poster artist and the insinuating salesman.

For somewhat similar reasons the attempt to base a theory of distril
tion on a subjective conception of “ real cost ” seems equally based
shifting sand. The new conception of “ real cost ” as “ effort and sac
fice,” which replaces the old classical concepts of an objective “ r
cost,” bears on its face the obvious disadvantage, which we have alrea
mentioned, that it rests on a basic dualism. There is not one type
“ real cost ” but two ; and there is no discoverable means of equating
two by a common term. It is no answer to say that a comparison betw
the disutility involved in an hour's work and the disutility involved
saving, say, £10 for a year, depends on which a particular individ
himself would prefer to do, because such a preference varies with
circumstances—how rich or how poor he is. A more fundamental di
culty than this is the very delimitation of “ sacrifice ”—the logical d
culty which Senior originally found in knowing whether to define “
stinence ” as including or as excluding the “ abstaining ” from the c
sumption of wealth that has been inherited. Similarly with the sacri
involved in “ saving ” something which has not been expected : is it
equal “ sacrifice ” to save a “ windfall ” gain as to save an income that
been fully expected ? If the answer is “ Yes,” the notion of sacrifice se
to fade into a bodiless ghost ; if the answer is “ No,” then the frontie
“ sacrifice ” turns out to be drawn along the highly unsuitable line
whether the income that is “ saved ” has been expected or is unexpec
One clearly cannot “ sacrifice ” what one does not possess ; and sacri
seems, on analysis, to be hardly distinguishable from “ opportun
cost ”—from the sacrifice of alternative opportunities. Reduced to th
terms, it ceases to have any universal significance as a conceptio
“ real cost ”—it will change its coat with every change of regime. At
rate, it will have no significance which makes it at all comparable to
“ real cost ” involved in working an eight-hour day. If one uses “ sa
fice,” or “ abstinence,” in any sense that is at all fundamental, then
not the rich men of the world who do the “ sacrifice ” involved in ca
accumulation. The “ sacrifice ” rests in the lowered incomes and
rowed consumption of the proletariat which permits the proper
class to enjoy its privileged income. But the “ sacrifice ” which in M
shall's theory is the basis of supply-price is clearly nothing so fundame
as this. If Pharaoh lent his slaves for building pyramids, it was not
slaves alone who, in Marshall's sense of the word, performed a sacrif
Pharaoh bore a “ sacrifice,” too, proportioned to the alternative en
ments which his slaves might have yielded if put to other use. That
“ real cost ” borne by Pharaoh was of the same kind and order as
of the pyramid-building slaves may have been the viewpoint of

es of the Egyptian Court. But from our more detached viewpoint of ries later, it seems hard to discover any useful sense in which ıoh's " sacrifice " was of the same order as that which he would incurred had he laboured at pyramid-building himself.

odern economics seems to have developed a technique which may prove of permanent value, at least in the study of particular detailed ts of the economic world. Here, it has certainly made a lasting con- tion. The conception of the functional equation and of increments margin makes possible a precision of thought entirely unattainable e, and renders the study of economic theory an intellectual disci- somewhat akin to the study of mathematics, even if of a more ele- ary and inferior order. At the same time, the glamour of the tech- has been responsible for considerable carelessness in its use. The ique seems to have been put to employments which it is quite ted to support, and has become enmeshed in not a little confusion rning the assumptions on which analysis has been based. By its ptions modern economics is confined to a limited enquiry—the tions of market equilibrium in face of a given scale of preferences on rt of consumers and in a given state of supply of the factors of pro- on. That is all it can really ask and answer. Yet economists have ally thought that they were answering—at least their audiences magined them to be—the much wider type of questions with which cal Political Economy dealt : questions such as the relation between s and the comparative merits of different types of economic system. nomics " and " Political Economy " are something more than dif- es of name : they are different enquiries, different in scope and and while the former may be superior in finish and precision, at the time it is necessarily more limited in its range. Until this fact is and realised I believe that little progress in the field of economic is will be made.

THE THEORY OF MONEY

sphere in particular where the technique of modern economic is has borne considerable fruit is in the Theory of Money. To this y the modern technique is eminently suited : the question is one ses of variation in the price relationship of money to commodities eral ; and no deeper assumptions are involved. To a large extent in lines of the subject were already laid down by Adam Smith and o ; but a good deal more than mere elaboration has been done by rk of Marshall in England and Irving Fisher in America, and more y still by R. G. Hawtrey and J. M. Keynes. This has consisted of mulation of the value, or the purchasing power, of money (or its , the general price-level) in terms of an equation which relates it to nificant variables on which it depends. This is the famous Quantity of Money. By itself it is scarcely more than a truism. It is an n of identity which of itself gives no key to the causal order of But its practical implications are wide and important, and are tly corollaries which are not immediately obvious to direct n-sense inference from the facts. To the politician as well as to the man in the street, for instance, the chaos of price changes and of exchang quotations which characterised the War and post-War years present something of a bewildering mystery. It was left to the economist to gi the rather simple explanation and to produce the recipe for moneta stabilisation after the War. Similarly, to-day, with the much-debat monetary aspects of the trade cycle—that cyclical alternation of tra boom and trade depression which characterises the modern econon system. And it is largely the economists' concern with the study of t special phenomenon that has prompted the most significant develo ments of monetary theory in recent years. In most pre-War formulatio of the Quantity Theory equation the value of money was expressed a function of the quantity of money in circulation and its velocity circulation, compared to the output of goods and the volume of transa tions. In more recent statements of the theory, emphasis has been plac on the volume of resources which are at any time held in the form money-balances, principally as bank-deposits. This quantity has tak the place of the velocity of circulation. The demand for money has be conceived as the proportion of the national income of goods and servi over which people have desired to hold command in money form ; a variations in this quantity have been accorded an equal place with chan in supply of money—at least in the explanation of short-period chan in the price level. More recently still Mr. Keynes, in his *Treatise Money*, has introduced a new set of equations, in which the relati between Saving (in the sense of money that is not spent) and Inve ment (in the sense of creation of capital goods, such as factories a plant) plays an important independent rôle in affecting both the price le and the volume of employment : when the former exceeds the latter th is the tendency for the price-level to fall and for unemployment to crease ; and conversely when the latter exceeds the former.

CONCLUSION

In America in particular, in recent years, there has developed an i portant school of economic thought that has studied the future economics along the lines of inductive enquiry.[1] Aided by the grea wealth of statistics which the modern world, and particularly Ameri affords, enquiry has proceeded along the lines of the study of bu ness indices and of price-correlations. On the other hand, in Sov Russia we find economists increasingly occupied with the speciali studies concerned with the concrete problems of economic planni —a development, perhaps, slightly reminiscent of the appro to particular problems of government adopted by the earl economists prior to the Physiocrats, and particularly by the so-cal Cameralists in eighteenth century Germany. It may be that the differ tial calculus and equations of market equilibrium have said all of wh they are capable, and that the future of economic enquiry lies specialised experimental and concrete studies such as these. Nevert less, such enquiries can hardly provide more than contributory evide to the solution of the problems of the general distribution of wealth a omparative results of different economic systems. This group of tions—those macroscopic, as distinct from microscopic, issues e economic order—will still remain to be answered, and to be ered presumably in terms of the concepts which classical Political omy created.

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[1] *Cf. The Trend of Economics* (1924), ed. by R. G. Tugwell.

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FINANCE

By

T. E. GREGORY

SYNOPSIS

introductory portion of the Article delimits the field of finance
estimates the significance of financial operations in the modern
d. It then passes on to a description of the mechanism of modern
ce. It is shown that, in spite of superficial diversities of form
to historical and other circumstances, financial organisation
where conforms to the same fundamental requirements, and a
y is made of the nature of the markets required by modern
omic communities. This is followed by a description of the opera-
carried on in such markets, and of the institutions which carry
on, including a description of the operations of Commercial
ing and of the problems involved in Commercial Bank organisa-
Upon a discussion of these issues follows an analysis of the rela-
of Government finance to money market operations, and of the
which are necessary to prevent the financial needs of Govern-
from disorganising the market.

w section commences with a description of the Capital Market
f the nature of the securities which it handles, including a dis-
on of the problem of speculation and the place of the Stock Ex-
e in economic life. This is succeeded by an analysis of the
ems of Company Finance and a discussion of the relations
en finance and economic well-being. There follows a section
g with the problems of Public Finance, *i.e.* the place of public
diture in the life of the community, the sources of public
ue and the limitations upon the power of the State to levy
on.

l section deals with the most urgent of all the financial questions
day—the relations between financial well-being and stability of
ice level—and concludes with a discussion of the part which
e played by Central Banks in the control of the price level.

FINANCE

I. ECONOMIC AND SOCIAL ASPECTS OF FINANCE

I

In that broad sense which implies the adjustment of means to ends, a
of ends to means, when both means and ends are thought of in terms
money, financial problems, financing and finance are in effect co-extensi
with economic life as a whole in any modern community. For econon
operations in such a community present themselves primarily in the sha
of an expenditure of money for the attainment of certain ends, and t
problem of how the money costs are to be met is inescapable. Everyon
income helps to “ finance ” his expenditure ; how everyone's income
to be adjusted to his expenditure, or his expenditure to his income, i
“ financial ” problem ; and the shifts and expedients which are necess
for the attainment of equilibrium—if, indeed, equilibrium is ever attain
—are “ financial ” operations no less vital or interesting to the individ
concerned than the flotation of an international loan is to the Rothschi
and the Barings who manage the operation, and to the Finance Minist
of impecunious States on whose behalf the operation is conducted. Nev
theless, for purposes of discussion here, “ Finance ” must be interpret
in a somewhat more definite manner. In one sense, all pecuniary tra
actions can be thought of as “ financial ” transactions ; but there
some pecuniary transactions which are thought of as being “ financia
in the technical sense, while others are not.

It might at first sight appear that the distinction which has to be dra
between the wider and the narrower uses of the term turns on a questi
of fact ; namely, on the question whether the resources involved
furnished by someone other than the recipient who intends to apply th
to some purpose. Thus, if John Citizen buys a house out of his own sa
ings, the operation is not, technically, a financial one ; whereas, if
borrows the money in the first instance from a Building Society and
pays the latter by instalments, the operation of buying a house *also*
comes a financial operation, because it involves the intervention of a p
fessional lender. But economic science has long used the term “ Pub
Finance ” to describe, not only those aspects of governmental expendit
which involve the raising of loans through the intermediary of techni
organisations, but also those operations, such as the raising of taxes a
the administration of State property yielding a profit, which involve
loan operations at all. Moreover, when additions and extensions are ma
to the plant and equipment of a joint stock company and the necess
funds are provided by means of withholding from the shareholders p
of the profits earned by the enterprise, the exponents of the new subj
of “ Corporation Finance ” would undoubtedly say that the operat

been " financed," just as the operation would have been called a cial operation if the company had raised new capital in the shape of ntures or shares in the London money market through the co-ation of a professional intermediary specialising in this class of ness.

he examples above show, too, that the distinction between financial non-financial operations does not always turn on the distinction be-n " capital " transactions and " revenue " or " income " transac-; for " public finance " is concerned in the main with the devices hich the current day-to-day expenditure is provided, and the opera- of the banking system with the provision of those temporary ad-es which anticipate the sale of the products of industry to the con-er.

t, though the distinctions drawn above are not sufficient accurately limit the frontier, they are guides to current conceptions. The truth at the frontier between financial and other transactions is vague and difficult to draw. Broadly, financial transactions are concerned with aising of sums of money for the purpose of meeting the costs of eco-c activities where these activities either do not bring in an immediate n or where they—as in the case of much of the work of governments not bring in a return at all, and their cost has to be met by a general on the resources of others, or, finally, with the raising of sums of ey in order to meet costs anticipatory of activities which are intended ing in a direct pecuniary return at a later date. Very broadly, financial distinguish themselves from acts of purchase and sale by their sub-ate, ancillary and provisional character. But it is useless to heap s on words in the effort to attach an invariable content to words h, in the mouth even of the technician, have a different meaning in ent contexts ; for to do so is to run the danger of excluding import-spects of the situation. Illustration may serve to make the situation er.

far the larger part of modern production takes place in anticipation mand. Production takes the form of a continuous stream of goods, of which are, at any moment, in a completed condition, others are merging from a semi-finished or partly finished condition, while at ame moment others are just beginning to be shaped out of the raw rials which they embody. At any moment the finished goods which en to be in existence constitute the " stock " of that particular com-y, but the constituents of the stock change from moment to mo- as goods are sold and are replaced by others which have just com- the production process. If consumption and production were com-y adjusted there would be no " stock," since the newly finished would be at once taken off the market. But in fact consumption is, e majority of cases, more discontinuous than production ; the ique of production makes it desirable to make the flow as even as ble. Stocks are accumulated in anticipation of demand. These , as well as the whole of the goods currently in process, represent a of costs ; wages, expenditure on fuel, raw materials, transportation e like. These costs are ultimately to be met out of the sale proceeds ; hey are they have to be met in some other way. In so far as they are

met by loans in anticipation of sales, whether these loans are made
bankers or whether they are made by those who furnish the raw materi
etc., being prepared to await payment until the goods are sold, a " sho
term " financial operation is involved ; production is being " finance
by the banker, or by means of short-term commercial credit. The eco
mic activities involve cost, and the outlay does not bring in an immedi
return ; the mechanism by which the time-interval is bridged betwe
outlay and return is part of the financial mechanism.

Again, production involves, not only current expenses in connecti
with the supply of labour and raw materials, etc., needed to bring go
to market, but it requires the creation of permanent units through wh
production is organised. These permanent units which undertake p
duction constitute the " business enterprises " of the community, ho
ever much they differ in detail and in legal form from one to the oth
They require, not only current assistance in bridging the gulf betwe
production and consumption at any moment, but a permanent volume
pecuniary resources ; the capital of the enterprise. The capital is inves
in innumerable ways ; in the provision of plant and equipment of
kinds. The costs involved are anticipatory costs, in the sense that they
intended to subserve the production of goods and services which al
bring in the revenue which will make the concern profitable. The probl
of raising this capital is a financial one and forms part of the gene
question of Industrial Finance.

Lastly, as regards the economic operations of Government. In so
respects the economic operations of Government resemble those of bu
ness enterprise. When a Government borrows in order to extend
telephone system, or when a municipality raises funds for erecting
electricity works, the sums so raised are anticipatory costs, just as t
would be if the services, the provision of which they are intended
further, had been provided by private enterprise, and the essence of
problem is not altered by the public character of the authority involv
though the legal position may be much altered thereby. There are e
analogies between private business and Government in that respect
which the difference at first sight appears so marked—the sphere in wh
Government undertakes to provide certain services and meets the cost
those services not by a charge varying with the amount of the service c
sumed, but by a charge on the general body of citizens, *i.e.* the spher
" taxation." For the finances of a club are also conducted on a not
similar basis—the general costs of running the club are met out of s
scriptions paid by the members ; though the amount of the ameni
consumed by different members may vary very greatly there is li
attempt to differentiate the tax-levy or subscription involved.

2

The impact of finance upon the modern world is of immense signi
ance. In what follows attention will be drawn to some salient charact
istics from the economic point of view. The social aspects deserve,
will receive, special consideration.

First, the *magnitude* of the operations involved. Leaving on one ether the supply of long-period capital, each year the financial isation has to finance the sowing and harvesting of the crops and aw material supplies of the world. Of the total production of food- s and raw materials, a part no doubt is consumed on the farms and production sites by the producers themselves ; but by far the larger now enters into commerce, and to finance the grower during the vals between sowing and final payment by the consumer is an operation nmensity of which is by no means always fully appreciated. For varia- in the price and volume of a single crop may make very great dif- ces to the strain imposed on the financial system. Thus, the world's t harvests in 1925–6 and 1930–1 differed by some 10% (3,344 mil- bushels in 1925–6 ; 3,675 million bushels in 1930–1). The average al price in the first year (cents per bushel) was 139½ ; in the year –1 it was 73¾. On the assumption that in each year 60% of the pro- on entered into commercial trade and required financing at some or other, the amounts involved fluctuated from £558 millions in –6 to £326 millions in 1930–1. Wheat represents only a single gh certainly very important) raw material ; in addition to the financ- f the raw material supplies of the world, the financial organisation o provide for the current needs of manufacture and commerce. out labouring the point any further, it is clear that a task of immense itude is involved.

ain, though figures relating to long-period capital issues are full of ls and have, therefore, to be used with great caution, it would appear in 1929—a year, it is true, of quite exceptional stock exchange ac- in the United States and elsewhere—the volume of capital issues uding loans to Governments as far as possible from the computation) United States, Great Britain, Germany and France alone amounted er £2,400 millions. Of this amount five-sixths was offered in the ed States, but the whole world participated in the provision of the ; and the figures will at least serve to show the scale of operations ved. (It must be remembered, however, that the effect of joint stock prise is in part only to *make visible* the flow of capital to business ; whole of business were to-day in private hands, as it practically was tury ago, the volume of capital demanded might be the same but atistical data would be much less available.)

ondly, these magnitudes involve complementary and, in the main, magnitudes in the shape of a flow of savings. It is not enough for nancial system to cause funds to flow from industry to industry or place to place in the appropriate amounts ; it must stimulate the h, and organise the collection, of savings, and must safeguard their ment to the extent necessary to guarantee the continuance of the This, as will presently appear, is a matter of great complexity ; not r, indeed, mainly because of the problems of *organisation* which are ed, but because of the social strains set up when a superstructure ncial obligation is built upon the foundations of a standard of value is not stable in purchasing power. But at this stage of the argument ufficient if the reader bears in mind that the task of finance is a e one ; it is not only a question of applying funds to certain uses, but ng to it that funds are there to be used.

Thirdly, in the modern world, the scale of Governmental finance h assumed dimensions alien to the inherited traditions, not only of t financial world itself, but of the business classes and the academic st dents of economics and politics. Partly as a result of the Great War, part as a result of the changing conceptions of the functions of Governme (and these conceptions have changed, not only because of the gener prevalence of democratic governments or dictatorships having to make popular appeal, but because science in general, and administrative scien in particular, is constantly opening up new avenues for exploitation), t scale of Government has expanded, and with that growth of scale t national Budgets have swollen also. This fact not only lends added si nificance to the technical problems which emerge—alternative syster of taxation and the like—considered as technical problems, but grea adds to the significance of Government finance as an element of the econ mic life of the community, however the positive functions of Governme may be regarded.

Fourthly, finance is one of the most potent, and almost the least i peded, of the agencies integrating the modern world into a single econon system. Tariffs interrupt the flow of goods, immigration and emigrati laws prevent the free movement of persons from place to place. Thou the flow of capital is not absolutely free, for nationalism dislikes the id of domination by " foreign capitalists," yet, in comparison to the impe ments in the way of the movements of goods and persons, capital mov ments are on a sufficiently broad scale to enable us to speak withc hyperbole of a world rate of interest and of a world capital market. Wit out such a free flow of capital it would have been impossible to devel the natural resources of the Americas, of Australasia and of the Far E to the extent that has actually taken place within the last century and half.

The social effects, to which we now turn, are no less striking. A ce tury ago it was still possible for the most prominent English private bank of his day, Vincent Stuckey, to explain to a Parliamentary Committ that the rural Englishman preferred the notes issued by a private bank " with twenty thousand a year in Land " to the notes of the Bank of En land. Until quite recently land and buildings and jewels constituted t *essence* of the idea of property : to-day the essence of property consists the possession of " securities." Finance has altered the face of the wor by making wealth *mobile*, in the sense that property rights attach direct not so much to physical things as to documents of title to such things, to rights to draw income, whether fixed or fluctuating, through institutio owning such property or from Governments and other public bod which have borrowed for many purposes, productive and unproducti on giving an undertaking to pay interest for the loan. Because property largely takes the form of owning such titles to income, the constituents a given fortune may change extraordinarily quickly : an " estate " of million pounds may mean very different things on two successive da simply because a different set of investments is held ; and the " manag ment of property " in these days means much more frequently than it d even twenty years ago the art of knowing when to sell and when to b securities of different kinds. The fact, so frequently deplored, that t rn capitalist is " irresponsible," " divorced from places and things," ply due to the growth of a species of property the essential character ich is its *mobility*.

o very striking results follow. Property is more vulnerable than it was before to attack, because so large a part of it consists merely in to income. And these attacks can come in an obvious and a subtle The obvious weapon of attack is taxation : the less obvious weapon hange in the purchasing power of money. An income tax of five ngs in the pound reduces the net yield to the investor to fifteen ngs, and is regarded as a high rate of tax. But, if the price level es, the real yield of the investment is halved. Experience during the l of inflation following the War proved that a price level is capable ubling, not only in the course of a year, but in the course of a day. ulnerability of fixed income rights to attack from fluctuations in the asing power of money is thus of immense significance in the modern in which, owing to the progressive transfer of certain types of unkings to Government or quasi-Government operation, this kind of ity is steadily increasing in importance. Property is more vulnerable y, further, because ownership is so much more clearly divorced from nsibility, and because the owners of such property seem so clearly ne from the obligation to reside at a fixed place for the performance rk which is the lot of the majority. Mobile property has created a seemingly free from the most obvious restrictions resting upon the r : it is not surprising, therefore, that the increasing publicity de- to the doings and activities of an apparently irresponsible social should result in an increasing resentment at the differences of for- thus indicated.

tly, the spread of international investment raises social issues of a l, though still of a very serious kind, for it involves the contact of alities and of races. When this contact assumes the form of the list employing local labour, of which he knows nothing at all except ich labour is willing to work for him or in his enterprise, it assumes es an unlovely and unamiable form. It is not only that the introduc- f modern capitalistic methods of production may destroy the indi- s standard of inherited skill and way of life ; it opens the door to tation of a crude kind, for the local labour may be helpless to pro- elf and the capitalist owner may be unable, owing to ignorance and ce, to impose conditions of labour and standards of life. Without the introduction of capital into these new areas helps to increase productivity, but the process of capital infiltration is not accom- l without serious elements of loss.

II. THE ORGANISATION OF THE MODERN FINANCIAL MECHANISM

e finance is essentially the process of linking up the supply of funds he demand for them, financial mechanism is in all countries in- to subserve the same primary purpose, however much the details structure may differ from place to place. A distinction must, there- e drawn between the different financial markets, each of which exists to link up a particular kind of supply with a particular kind of mand for capital, and the nature of the agencies involved. In all countr there is a marked tendency for the distribution of functions among various financial agencies to be determined in large part by histori causes, the importance of the historical factor itself varying, of cour with the various financial centres. Old financial centres, such as Lond or Amsterdam, will possess a financial structure more deeply marked historical survivals than newer markets such as New York or Berlin. T main line of division concerns the degree to which there is division labour or integration of function among financial agencies, *i.e.* the ext to which in each sub-market there are separate firms or institutions alternatively, the extent to which the same group of firms will perfo different functions whilst maintaining identity of legal form. Thus old private banking firms of such centres as London, Paris, Amsterd and New York not only concern themselves with the issue of new se rities, but are also concerned with the financing of foreign trade and w dealings in bullion and foreign exchange. That is, the " merchant ba ing " firms not only act as " acceptance houses " but also as " issu houses," side by side with firms which specialise more closely in one other of these directions.

Every modern financial structure comprises five different divisions

(1) A market in which funds which are only available for short period time can be handled. This market is known as the Short Loan Mark The funds which flow to this market come to it from other institutio mainly from the Commercial Banks and the large private banking insti tions. The borrowers in this market are the dealers in bills and the deal in securities, or, to put the matter in technical language, Call Mo is borrowed by the Bill Market and the Stock Exchange.

(2) A market in which funds available and required for moderat long periods of time are lent and borrowed. This market in all count is the field of activity of the Commercial Banks. They absorb the curr spare funds of the community, which constitute their deposits, and lend the bulk of them to the business community in the shape of co mercial loans and overdrafts.

(3) A market which exists to facilitate, firstly, the creation of inve ment securities and, secondly, the transfer of long-period securities. T a twin organisation is necessary, of Promoters and Issuing Houses, on one hand, and of an organised Securities Market, on the other. T latter market is the Stock Exchange, together with its membership brokers (and, in London, of jobbers).

(4) Each financial structure comprises a series of specialised insti tions, made necessary by the desirability of safeguarding savings i special way or satisfying a particular kind of demand. These speciali institutions are of many kinds : Savings Banks, Agricultural Banks short and long term loans, Building Societies, Insurance Companies Investment Trusts, to name only those which are familiar to readers both sides of the Atlantic.

(5) Lastly, there is one specialised division of the financial struct which carries out functions of a most important kind. This is the Cen Bank ; the primary function of this institution is to act as the Cen

visory Agency of the financial system as a whole. How it carries out ctions will be discussed at a later stage.

anised money markets differ from one another, as already pointed the manner in which the agencies operating in these various mare related to one another. Thus, in London, the Bill Market is more ant as a source of demand for Call Money than the Stock Exchange: erse is the case in New York. In London the function of promoting suing new securities is in the hands of the old merchant banking in Berlin this function is carried out in the main by the Commernks, in New York by private banking firms *and* the special subsicreated for this purpose by the Commercial Banks. The Savings are a more important element in the German banking structure the British. The dealers in bills in London are specialised, in New hey are not. Building societies have recently acquired great imce in England; agricultural banking in the U.S.A. But the struca whole covers the *same range of activities*, and this is the important The survey of financial operations which follows is built up on the f the various sub-markets already described.

III. THE SHORT TERM MONEY MARKET

ds borrowed and lent in this money market range from the day-tol loans to loans lent from one period of settlement on the Stock ge (in London) to the next. The essence of the " call " loan is that t subject to very easy terms of withdrawal. But why should anywilling to borrow or lend on such terms? It seems at first sight ime that it can pay anyone to borrow for 24 hours, running the risk of to repay the money, or for anyone to lend for the same period of time. explanation lies in the facts that *any* rate of interest for *any* length is better than no rate of interest at all, and that, from the standthe lender, a loan which is repayable at very short notice is a great ience, since it earns something and yet is liquid. (One day's inter365,000 at 2½% per annum is £25, about one month's salary of a ell-paid London bank clerk, so that one year's salary can be paid sting this amount for a fortnight.) Hence the great financial ins like to keep a certain proportion of their funds permanently in ans; they are a " second line of defence," ranking next to actual d in vault or at some other bank as liquid funds. And it is also conto borrowers to have loans easily repayable, since, if money can ned more cheaply elsewhere, the first loan can speedily be repaid wing at a lower rate elsewhere. The *price* which is paid for a very vestment is, from the standpoint of the lender, a very low rate of from the standpoint of the borrower, the low rate he pays is comn for the risk of having the money suddenly withdrawn.

upply of such funds comes from two main sources. The normal omes from the great Commercial Banks which, as already pointed ularly invest a certain proportion of their deposit money in this t there are special sources of supply as well; funds awaiting perinvestment in the hands of financial institutions, *i.e.* proceeds of d sums available in anticipation of dividend requirements and the like. The net effect is that the supply of “ short money ” as a whol more regular than individual portions of it.

The users of “ short money ” are, primarily, in London, the dealer bills ; in New York the Stock Exchange brokerage houses. Not all funds used by bill dealers and stockbrokers is subject to short terms recall, but much of it is. Whether employed in the purchase of bills o the purchase of securities (by being lent to the customers of Stock change houses who desire to buy securities they cannot immediately for) the money so lent flows back into the great stream of circulation, which industry and trade are nourished. For the bills of exchange bou by means of this borrowed money represent, to a large extent, the c rent movement of produce and goods in the International Trade of world, and the securities which have been bought by speculators with b rowed money have had to be sold by someone else, so that the purchas power at the command of the seller has increased. In addition, call mo borrowed by bill-dealers, under post-War conditions, is largely used them in buying Treasury Bills, a bill of exchange issued by Governm to finance its current expenditure, so that, again, through the channe the Treasury, the money borrowed flows back into the general stream

There are problems, however, attaching to the existence of the S Loan Fund. The fundamental principle of every money market is money paid for must be money used. Now, this means in practice whilst *specific* loans are liquid, the total of the Short Loan Fund is no a broker borrows £100,000 from Bank A, he does not lock it up, but b bills with it. Suppose that the Bank calls in the money, what can he He can either re-sell the bills he has bought, which may prove unpro able, or re-borrow. But the possibility of re-borrowing is conditioned by Short Loan Fund *as a whole* remaining unchanged ; if all the lending stitutions withdraw simultaneously it becomes impossible. Under th conditions, to re-sell what has been bought with the borrowed money become unprofitable, for everyone will be trying to sell at the same ti

One of the functions of the Central Bank is to prevent the Mo Market from becoming “ jammed ” in this way. For the Central Ba both in London and New York, stands prepared to buy bills of excha at a stated price, or to advance at a stated price ; alternatively, to cr conditions in the Short Loan Market which will *restore* the normal pro of its operation, which it can do by the device of buying securities in open market, thus adding to the supply of funds in that market. power of the Central Bank to act in these ways is, as we shall see la the key to the understanding of the very peculiar position which it cupies. But the upshot of the present section is this : while the Mo Market functions normally, short money really is a liquid form of inv ment, but only because it is assumed, by both borrowers and lend that money borrowed and lent can be re-borrowed and repaid thro loans by someone else.

IV. THE INTERNATIONAL SHORT LOAN FUND

There is one form of lending for short periods of time which, since War, has assumed enormous proportions and presents peculiar feat own. This is lending by institutions in one Money Market to in- ons in another. The total of the sums so lent and borrowed consti- he International Short Loan Fund. Before the War London was eat lender in this way ; to-day London is both a lender and a bor- while it shares its former predominance with New York and with Though the amounts involved are unknown, it is probable that a f something like £1,000,000,000 is involved in the aggregate.

A large part of the international trade of the world is " financed " h London. Bills are drawn on the importers of goods in Hamburg nghai, but these bills are validated, *i.e.* accepted, on behalf of the porters by London banking houses, who rely on receiving funds for g the bills as they fall due from the importers. Pending the date of nt, the bills are discounted in London, *i.e.* ready cash is given for payments, so that the banks are able to advance to the *exporters* in ation of repayment by importers. So long as the remittances are received, London is lending abroad the present value of the bills, so far as the amount of bills is increasing, the volume of London's lending is increased.

When the rate of interest is higher, say, in London than in New it pays American firms to invest in London, *i.e.* to lend money to n bankers. What really happens is that in London dollars are sold e having debts to settle in America, and the pounds paid for these represent the proceeds of the loan. As a general rule, no gold is y transferred ; from the banking point of view the transaction is urely a book-keeping one, which has the effect of enabling Great to meet (temporarily) one set of American debts by creating r.

Thus it may very well be the case that London is lending on the nd and borrowing on the other. The situation in New York may er grounds, however) be the same. A foreign Government may be ing in New York by means of a long-dated loan. The proceeds of n (dollar proceeds) may be sold by this Government to the local Bank for cash, say, marks. The Central Bank in question may hold dollars permanently as part of its reserve, in which case New ill be a creditor on Long Term Account and a debtor on Short ccount.

When a currency is disorganised, banks and business firms, as well te individuals, try to escape from the consequences of further de- the value of the currency by holding foreign bank balances. Thus, the period of currency disorganisation in France, many millions ds of English money were acquired by French interests. France, r as these sums are held permanently in this country, is really Great Britain a loan to this extent : in so far as French balances nanently kept in New York, France is making a loan to the United

the International Short Loan Fund, when analysed, is an extra- ly complex thing. Instead of great financial centres being bor- nly, or lenders only, they are both, and their net position may be orrowing at one time and lending at another.

are the dangers which accompany so considerable an extension of the system of international short-term lending as the last decade has w nessed ? They are two in number.

First, the danger of a sudden withdrawal of these funds, which m put the Central Bank into a position of very great difficulty. For the n mal weapons of defence may be unable to prevent these sums from be withdrawn, and a heavy loss of gold may be the consequence. If, for ample, French balances are withdrawn from London, the techn method by which this is done is by sales of sterling in the Paris fore exchange market ; this reduces the franc value of the pound and, if t reduction is great enough to make the costs of shipping gold from Lonc worth while incurring, gold *will* be shipped. Hence a market with he foreign balances due by it is in an essentially unstable situation. Thi why the influx of foreign balances into the London market is so of spoken of as the influx of " bad money." The money is " bad " sim because its withdrawal may, later on, involve heavy gold shipme This, again, explains the statement, so frequently heard in these da that the more gold a bank has lost, the less the danger of its losing more, for, by losing gold, the foreign balances have been depleted.

Secondly, what is lent " short " must be invested " short " ; that international funds borrowed for short periods cannot be invested fo period of time longer than that. The danger is that funds so lent will invested primarily in bills of exchange. An increase in the demand bills raises their price, *i.e.* lowers the market rate of discount, which ma the bills dearer to buy. Now, if the Central Bank, for reasons of its o desires to see the market rate of interest maintained at a certain level, policy in this respect is endangered if an inflow of funds from abroa pressing the rate in a downward direction. For, if the rate falls low enou bills will be attracted to that centre for sale, *i.e.* the high current price (rate of discount) leads to fresh bills being created for the purpose of be discounted, and if borrowers are foreigners an *outflow* of funds may initiated, ultimately leading to gold movements. Thus, any benefi effects produced by the previous inflow may be neutralised.

The growth of the International Short Loan Fund has thus created r problems, calling for some revision of the traditional attitude on the s ject of the benefits to be derived from acting as an international cen That attitude was based upon the popular conception of London a predominantly lending centre, and had not taken into account the ficulties arising when a centre is at times more of a debtor than it creditor.

V. THE COMMERCIAL BANKING FIELD

It is through the Commercial Banks that industry, trade and comme the professions and the general public usually come into contact with machinery of finance, and this in two ways ; as lenders to the banks, as borrowers from them. Although it is habitual, in discussions of th subjects, to lay stress upon the functions of banks as *lenders*, their fu tions as borrowers are equally important. Many people and even m industrial and commercial firms have never found it necessary to bor from their banks, but they find it absolutely necessary to maintai banking account. The fact is that the modern world, at any rate n English-speaking world, habitually uses the banking system, not or the purpose of borrowing, and of depositing spare funds, but for rpose of making its payments. Transfer by means of cheques is so ient that the majority of transactions, certainly by value, most pro- ılso by number, are made by means of cheques. In Great Britain stence of a stamp duty upon every cheque drawn no doubt acts e extent as a deterrent against the drawing of cheques in settle- f accounts which can be met without inconvenience by the use of anknotes ; but in the United States no such deterrent exists and of cheques for even the smallest payments is then habitual to ossessing a banking account. And the possession of a banking ac- formerly in England, at least, the sign of a certain superior social has been made easier on account of the intense competition for ers by the banks themselves. The first group of questions which therefore, concerns the relationship between banker and customer.

(a) *The Deposit Side of Banking*

Great Britain a distinction is drawn in the literature of banking n Current Accounts on the one hand, and Deposit Accounts on the a distinction which corresponds to the American division between d Deposits and Time Deposits. The importance of the distinc- Great Britain is supposed to lie in the fact that only Current Ac- are available to be drawn against on demand by cheque, while g no interest ; sums standing to the credit of Deposit Accounts are ole only at notice, but carry interest. In practice, however, these istinctions do not quite obtain and, in any case, practice in the of England differs much in these respects from practice in the of England. In the North, interest is paid upon the minimum kept on the credit side of the account. In these circumstances, not much advantage to the customer in keeping two accounts al- as a matter of fact, it is known that, in consequence of the trade ion, a considerable increase in the volume of Deposit Accounts has king place in the last eighteen months, taking the whole banking into account.

e U.S.A. the position is very different, owing to differences in the gulations relating to Reserve Ratios. In Great Britain there is no y obligation upon the Commercial Banks to keep any cash re- all, much less a statutory amount. In the U.S.A. the Federal Code imposes on all the Member Banks the obligation to main- the twelve Federal Reserve Banks a reserve against demand of 7, 10 or 13%, according to the physical location of the Mem- k. Against time deposits a uniform cash reserve of 3% only has pt. This distinction has had the effect, perhaps entirely unexpected, ly stimulating the growth of time deposits. For a bank may be ff, financially speaking, by paying interest upon a Time Deposit, same time it can cut its reserve requirements down from 13 to effect, the growth of Time Deposits under these conditions is unt to a net reduction in the reserve requirements imposed on the Banks of the System.

The relationship between banker and customer is much wider than implied in the mere keeping of an account by the one for the other. America, in particular, banking competition has resulted in the bar being prepared to carry out a wide range of services on behalf of cu tomers, some of which can hardly be regarded as falling within t sphere of banking at all. But in Great Britain the custody of docume and securities, the performance of Executor and Trustee functio (through subsidiary corporations in some instances), etc., have ve much widened the range of contact.

(*b*) *The Loaning Side of the Banker's Activities*

A distinction must be drawn between the following three elemen (1) the time element, *i.e.* the length of time for which the loan is mac (2) the charge made for the loan; and (3) the nature of the security quired. So far as Great Britain is concerned, advances by bankers into two great categories—loans and overdrafts. A loan is made wl a fixed sum is advanced for a fixed period of time, say three or months. The borrower pays interest upon the amount for the period time in question. An overdraft is the right to borrow up to a gi amount in excess of the customer's own credit balance and, therefo the amount " overdrawn " depends on the extent to which the facili granted are actually made use of during the period of time for wh the facilities are granted. Hence the overdraft is a much more ela form of borrowing. Though in Great Britain the distribution of loan overdraft facilities is in part a matter of local custom and tradition (lo in the South, overdrafts in the North), it seems to be the case t overdraft facilities are growing at the expense of loans.

The charge made is governed, in the case of Great Britain, by a c ventional relation based upon the movement of Bank Rate, *i.e.* the offi minimum rate fixed by the Bank of England for the discount by it bills of exchange. Charges range from ½ to 1½% over bank rate, wit fixed minimum of 4, 4½ or 5%. That is, when bank rate falls below 3 loan charges to customers no longer fall with it. Under existing arran ments, also, the interest paid upon deposits (or upon minimum balar on current account) varies in Great Britain with the bank rate, be fixed at 2% under bank rate for deposits subject to 7 days' notice of w drawal, with a maximum of 5% interest. It is clear that the banks m maintain a margin between what they charge and what they can aff to pay to depositors, for out of the difference the banks must meet t charges for staff, buildings, etc. It is true that on a large part of their t deposits banks with branches in the South of England pay nothing, current accounts in the South carry no interest. On the other hand, w earning more than bank rate on their loans and advances, banks e nothing at all on their actual cash reserves, and a good deal less t bank rate upon such part of their funds as they invest in the Short L Market, or in the very finest classes of bills of exchange which they buy in the Bill Market. Their earnings on securities, also, since these mainly Government securities, tend not to be more than 4 to 5%, on Treasury Bills, of course, considerably less. The earnings of the ba d, not only upon the manner in which their funds are invested, but the properties in which they are so invested. In this respect, the banks tend to follow a fixed routine and, although their propor- are subject to a certain amount of change (for loans and advances to ners fall off in periods of bad trade and rise somewhat in periods sperity), the amount of elasticity is not very considerable. Bad by lowering the rate to be earned in the Call Loan Market, reduc- th the amount and the yield of loans and advances, raising the price erefore the yield of long-dated securities, must affect bank earnings ely, especially as the cost of staff and buildings, etc., remains more the same, whether trade improves or declines.

he United States, the place of the overdraft is a much more modest an it is in Great Britain : the normal form of a commercial advance he shape of a loan secured by promissory note or other collateral y—Stock Exchange securities, produce warrants and the like. But ises the third point, namely, the nature of the security required. and overdrafts can be divided into two groups, secured and un- d. Where the loan or overdraft is " unsecured," it means in effect e banker's belief in his customer's ability to repay rests upon his al knowledge of the customer and upon his knowledge of how the to be used. But when a loan is " secured," there is some piece of ty or some legal right which the banker can utilise to compensate non-repayment of his advance. The most obvious illustration of st kind of security is furnished by goods or produce in course of ent pledged to the banker pending realisation of the proceeds ; st obvious illustration of the second kind of security is a guarantee d parties to the banker that, if the borrower does not repay the hen called upon, the guarantors will do so in his place. Since the s of tangible and intangible property are very great, it follows that urity held against loans consists of many different kinds.

(*c*) *Problems of Commercial Banking Organisation*

first duty of the banker is to secure the safety of the deposits en- to him ; the second, to invest the funds at his command in such a to secure, as far as he can, an even flow of profits. Security and bility alike depend on spreading the risk and it is the desire to risks which explains why bankers keep, or try to keep, their funds d in certain conventional proportions along certain lines. What nes are is partly a matter of law and legal conditions, partly a of the investment opportunities open to the banker under circum- of time and place, largely a matter of experience. The old adage be a banker one must know the difference between a mortgage ill of exchange throws light upon one fundamental aspect of the liquidity. Since the banker has liabilities a large part of which able at a moment's notice, some part of his assets, *i.e.* his cash and some fraction of his loans, must be equally available at a 's notice. In Great Britain the Commercial Banks are entirely n any sort of legal interference : in the U.S.A. the position is very t in this respect. Not only are particular classes of banks prohibited from making loans of a certain kind, or holding securities certain descriptions, the law goes further and limits the amount which be lent to any one customer. But what is attempted to be done by force of law in the United States, the force of custom and experie tends to do in Great Britain.

In the final analysis, what has been said above of the liquidity of funds invested in the Short Loan Market is true of the investment funds generally. Bankers' loans are used by the borrowers for spec purposes. If all the depositors were to try to draw out their funds sim taneously, every bank, however sound it might be, would be bound close its doors, since it would be impossible to sell securities and cal loans sufficiently quickly and on a sufficient scale. A run on a single b can be met by assistance from other banks, a run on all the banks toget can only be met by assistance from the Central Bank, and it can only by the device of printing more notes. For the absolutely liquid assets (is, the Cash Reserve) even of the Central Bank are not large enough meet more than a small proportion of the total liabilities which the ba together owe the public. The safety of each bank is in part dependent the size of its liquid resources ; the ultimate safety of the banking sys as a whole lies in the fact that not all the depositors will normally ask their money simultaneously and, should they do so in consequence panic, in the fact that the Central Bank will come to the assistance of Commercial Banks by a free use of the printing press. But large rese and sound investments by themselves will not save the system as a w in moments of general pressure.

If the banking structure of Great Britain is compared with that of United States, a striking difference in the form of organisation appe The entire commercial banking business of Great Britain is done group of 16 Joint Stock Banks, that of Scotland by 8 banks, som which are owned by the larger of the English banks, which also co most of the remaining provincial banks of Lancashire. Five banks in do the main bulk of the banking business. The contrast with Ameri startling, if it is borne in mind that there were 7,707 National Banks 1,633 Trust Companies recorded by the Comptroller of the Currenc 13th December, 1928, not to speak of the thousands of banks organ under State Laws. English banking is primarily organised on the of a few large institutions covering the country with a networ branches ; American banking upon the principle of " unit banki Though, in certain States of the American Union, branch banking is mitted and is rapidly making headway in such States, and though device of " chain banking," *i.e.* single banks associated through a hol company, represents a compromise between the British and Ame systems, yet what has been for a generation a *fait accompli* in G Britain (and, indeed, in most parts of the world) is still a matter of a controversy in the United States.

The purpose of branch banking is to assist in the geographical di bution of risk and to draw deposits from as wide an area as poss So long as industry continues to be largely localised, geographical di bution of risk demands a widespread organisation, and districts ric deposits can be drawn upon to supply the deficiency of borrowing *n the limits of a single organisation.* From the technical banking point there is a further advantage derived from a growth of scale 1 must not be overlooked. The cheques paid in over its counters be cheques on its own customers to a greater extent the wider rganisation. But to pay such cheques no cash is required; all s needed is two book-entries. Growth of scale implies *economy in es*, a smaller proportionate amount of cash has to be kept relatively al business, because fewer cheques will be presented through other , and more through the branches of the same bank. Thus consider- dvantages accrue; increased safety, economy and profitability.

w far are these advantages *only* to be obtained by means of branch ng? American critics would say that it was possible to obtain the results in other ways. It is possible to obtain " out of town " cus- rs, *i.e.* to get customers in places where the bank does not operate, he larger American banks do, in fact, try to obtain such customers. er, it is always possible for even a small bank to spread risks by g use of the facilities of the Central Money Markets. It can buy in the Bill Market, hold gilt-edged securities which can be readily on the Stock Exchange, and lend money at call or short notice. ican banking organisation *facilitates* such methods of distributing by the fact that the large banks in cities like Chicago and New York " correspondents " for hundreds, in some cases thousands, of small scattered all over the vast area of the United States. Lastly, the gist for " unit banking " would argue that, even if such banks have disadvantages to contend with, they also have some unique advan- They are less bureaucratically organised and inspired and, because are more restricted in scope, they are more likely to be interested in iccess of local enterprises and more prepared to see such enter- " through " a period of depression or bad trade. The bigger the and the wider the network of branches, the more indifferent such must become to the fate of particular districts, industries and firms.

is line of argument proves perhaps too much rather than too little. ver the world, even in the U.S.A., the organisation of banking is g towards the British, or, rather, the European system of branch ng. The charge of bureaucratic handling of business can be launched t unit banking as easily as against branch banking, when the unit attain a certain size—in fact, some of the New York banks are now g the largest in the world. Lastly, the association of a bank with a ular locality may lead very easily to such an intimate dependence of nk on the prosperity of that locality that it becomes a danger to the itself: a danger which is exemplified in the wave of bank failures in gricultural regions of the United States whenever agriculture is g through a phase of falling prices. It is the duty of the banker to wider view of the situation than the business man. When he meets he business men of his own locality, he is liable to take their view sily to overlook the dangers of local over-expansion. One may that banking is becoming less associated with the hopes and fears their localities, but the trend towards large-scale operation is teristic of business generally that small local banks have no e resources to finance such large concerns easily. Because the borrowers are becoming larger in size, the banks must become larger to otherwise the customer may be too large to lend to safely, for banke know that a single big account is more dangerous than ten separate a counts aggregating an equal amount.

VI. GOVERNMENTS AND THE MONEY MARKET

The State in the modern world administers for the general benefit the citizens of the country an enormous revenue. Since revenue a expenditure by Government are about one-fifth of the national inco (£800 millions against, say, £4,000 millions) it is clear that the manag ment of this immense amount of money requires very great care in or to prevent the smooth working of the money market from being advers affected.

It is possible so to organise the system of Governmental finance as separate it altogether from normal money market channels. Where t is done, the so-called " Independent Treasury System " comes into bei During a large part of the nineteenth century the financial procedure the Government of the United States was based upon this system. T attempt was made to segregate in the American Treasury the revenues the country in cash (gold, silver and notes) and to keep them there u they flowed out again to finance Government expenditure. It is easy see that, when revenue and expenditure are heavy, intolerable difficult are thereby created. If the period when tax collections are heaviest co cides with the maximum demand for accommodation for agriculture industry, the banks are put into a most embarrassing situation, for th funds are drained away from them at the very moment when they n them most. If the bulk of the expenditure falls at a time of busin slackness, the banks are faced with a plethora of funds. Thus the In pendent Treasury System tends to accentuate the degree of variation money market rates, and for that very reason has had to be abandon But even association of Government with a Commercial Bank does quite meet the situation. What is wanted is association with an institut which will be in a position to even out the ebb and flow of money due the financial operations of Government. Such an institution is the C tral Bank. The management of the Government's current account and its short-term and long-term borrowing operations are entrusted to because it, and it alone, is in touch with every part of the Money Mark

From the present point of view, the task of managing the finances Government is essentially that of preventing a temporary excess of venue over expenditure from depriving the Money Market of funds, a of preventing an excess of expenditure over revenue from flooding market with funds. The first would result in rising money market rat the second in falling rates. The instruments of adjustment are the Ban own lending operations and the manipulation of the size of the " Flo ing Debt." Since the War the British Government has always been debt to the Money Market, the evidence of indebtedness being Treasury Bill. Periods of pressure lead to an increase in the Float Debt, *i.e.* Treasury Bills plus the amount lent directly by the B England (these advances are known as Ways and Means Adva ds of ease lead to a reduction in the Floating Debt. Now, when there excess of revenue over expenditure (as there usually is in the first months of the *calendar* year, which correspond to the last three hs of the *financial* year, when the bulk of the Income Tax proceeds owing in), the way to prevent a shortage in the Money Market is to ff Floating Debt, because this adds to the resources of the market. the way to prevent an excess of expenditure resulting in unusual ease increase the Floating Debt. The Bank's own loans can be used as a cing factor, to add to the supply of cash in periods of stringency, to e cash (by *not* lending) in periods of ease. If revenue is flowing in than Floating Debt (Treasury Bills) is being paid off, the Bank can more freely : in periods when an increase in the Floating Debt is not g funds off the market fast enough, the Bank, by reducing its own , can stiffen up rates and prevent an abnormal reduction in the price ns in the Money Market.

e system so far described is the British system. In the United s, though the Treasury Bill has recently been introduced, the same ion is carried out by the purchase and sale of Certificates of In- edness. At the quarterly dates when income tax receipts, on the one , and interest payments, on the other, create a situation of difficulty market, the Federal Reserve Banks, by the purchase of special One Certificates of Indebtedness, by not buying more bills to replace ring ones and by other devices, attempt to even out the ebb and flow oney.

VII. THE LONG-PERIOD CAPITAL MARKET

1. *The Machinery of Issue*

the modern world, savings can be devoted to the acquisition either gible property, such as land, houses, furniture, pictures or jewellery, property rights, such as mortgages, bank deposits or "stocks and s." It is with the last class that we are concerned here. The classes of l-rights which are offered to investors and which are handled in the period capital market take the following main forms :

The obligations of Governments and Public Bodies of all kinds. tionally, Governments have chiefly borrowed for two main pur- —for waging war and for covering the deficit on the Budget even nes of peace. But such unproductive forms of borrowing, though nsible for the greater part of existing National Debts, are not the purposes for which Governments can borrow, and they do not re- nt the reasons why subordinate Public Bodies borrow. The fact is he control and operation of certain essential public services, the y of railway and other forms of transportation, the provision of light, e, docks, water, etc., are more and more passing into public hands. e, Government debts may be raised, and to an increasing extent are , for productive purposes. The interest payments necessitated y are not a charge against the taxpayer, as they are in the case of un- ctive Debt, but are met out of the revenues earned by the under- s acquired, created or extended by the use of the funds so borrowed. is, in other words, no essential difference, in the economic sense, between a Government borrowing for reproductive purposes and t borrowings effected by a " Public Utility " enterprise organised in Jo Stock Company form.

(*b*) Obligations of all kinds issued by non-Governmental bodies. The again, fall into three main groups :—

(i) Secured obligations. The most important class of such securities co sists of mortgage debentures or mortgage bonds. By means of such bon or debentures, the borrowing undertaking secures to the investor the d performance of the obligations it has assumed by assigning to him p or all of the assets, tangible and intangible, present and future, owned the undertaking. In the event of default, therefore, the investor can p tect his rights by seizing the assets held as a pledge.

(ii) Unsecured obligations with Preferential Treatment. Two m classes of investments fall within this category. First come what are lega evidences, not of ownership *in* the undertaking, but of *loans* to it un cured by specific pledge of property, such as Income Debentures Income Notes, where the investor is merely promised priority of inter payments, though this priority may be safeguarded in various ways. N come evidences of part-ownership in the concern, given priority of terest payment over other classes of *owners*. This gives one the great cl of Preference Shares. Such preference shares may merely carry the ri to payment of interest in preference to all other classes, but with guarantee that such interest will in fact be paid. Or the preference sh may be made *cumulative*, in which case interest unpaid in any one y is carried forward to the next ; or the preference share may be made b cumulative and *participatory*, in which case, if earnings or dividends d tributed to other classes of owners exceed a certain amount, the pref ence shareholder participates to a further extent in the prosperity of concern, over and above the fixed interest to which he is entitled.

(iii) Lastly come various classes of share capital which rank after classes mentioned (if the undertaking has issued more than one class obligation or capital) in the distribution of income. In general, this cl of rights may be called Residual or Ordinary Capital, and the sha Ordinary Share Capital. Such capital is itself divisible into Prefer Ordinary and Deferred Ordinary Capital. Where in an enterprise b these classes of shares are issued, the Preferred Ordinary will rank, regards dividend payments, before the Deferred Ordinary Capital, wh represents the true residual element of ownership in the concern.

The presence, or possible presence, of rights of so many differ kinds within the same enterprise profoundly affects the practical work of the joint stock company. But, whether many or few, all such securi have in the first instance to be issued to the public, and an elabor mechanism exists for the purpose. Issue covers three main elemen Promotion, Underwriting and the technical Act of Issue. Promoti *i.e.* the processes necessary to the formation and legal creation of concern, of course, only arises where the public is asked to take capital or debt in a *new* enterprise, but issue and underwriting operati cover, not only capital operations on behalf of a new concern, but cases where existing concerns offer new capital to the public or wh existing public authorities desire to borrow afresh!

motion and issue may be united in the hands of the same institu- and the same institution may also agree to underwrite part or the of the issue. On the other hand, these various activities may be ed. And, in many cases, the activity of issuing must be divided into arts, one purely mechanical and subordinate, the other substantial ssential. The essential part of the work of issue consists in preparing atements and particulars by which the facts are brought to the of the public, in discussing with the promoters of the enterprise or the borrowing Government the terms on which the issue to the is to be made, the time and conditions under which it is to be and the like relevant circumstances. The subordinate part of the f issue concerns the mechanical aspect of actually receiving and nting for the subscription. This mechanical work may be done by the e House" itself; it may be left to a Joint Stock Bank, though, British practice, a Joint Stock Bank agreeing to take subscription he counter and allowing its name to appear on the "prospectus" ne statements relating to the issue) does not thereby assume any nsibility as to the goodness of the issue towards subscribers.

ne may take two main forms. The issuer may offer *on behalf* of the rise or Government, receiving a commission or a payment ar- l on some definite basis for the work or trouble and expenses ed. Or the issuer may have undertaken to buy up the entire issue at l price and offers it to the public at another (and necessarily higher) This constitutes technically the form of issue known in Great as the "Offer for Sale"; in America, it constitutes the act of erwriting." The advantage of this form is that the enterprise is d of all further trouble; its issue has been taken "firm" by what umed to be a reliable house or group of financial houses, and they ow run the risk of being unable to dispose of the security.

s risk is necessarily always present though to a smaller or greater according to the intrinsic soundness of what is being issued and ate of opinion as regards the outlook for securities in general. dingly, in Great Britain the issue house safeguards itself by secur- *tingent* subscribers to the issue, and this constitutes underwriting British sense. In return for a commission (the "underwriting ssion") individuals and firms will promise to take up any portions issue not sold to the public. Hence—at a price—a market for an an be found, even if the investing public is not in a mood to bite at new securities.

clear that the machinery of issue is complex. Who are the issuers? ndon there is a group of firms, traditionally known as the "Issue s," firms like Barings and Lazards and Schröders, who, however, main confine themselves to international loans and have little to do ritish industrial issues. A second group of issuing houses is com- of certain large Stock Exchange firms, dealing partly with Colonial partly with British industrials. Lastly, during the Stock Exchange of 1928, a certain number of new issuing agencies appeared, some not of a very high-class character. British Government loans are d by the Bank of England; and a few very large corporations are ong enough to issue directly on their own behalf through their banks. The underwriting of new issues is arranged for by the issuing hous Each will have its own list of persons and firms who will habitually unde write for it (other finance houses, brokers, investments trusts), t principle being that the underwriter must take the bad with the good a take issues as they happen to come along. But there is a certain compe tive fringe ; at times when the securities markets are active there will b certain competitive scrambling for underwriting privileges. A hi underwriting commission points to a weak issue and a weak mark situation. Moreover, the underwriter does not always live up to his ob gations. In recent months the liquidation of certain companies creat during the preceding boom has disclosed some very bad cases of hi underwriting commissions paid to individuals unable to take up t shares on a failure of the public to subscribe.

The American machinery of issue resembles the British in that t issuing houses include large brokerage houses and private bankers li the Morgans, but differs in so far from the British situation that in rece years the great New York Commercial Banks have created subsidia “ Security Corporations,” which handle issues which the Banks the selves are not in a position to do. To such dependent corporations th are no exact British analogies. Moreover, the *marketing* of securities in t two countries presents considerable differences. A large part of t securities issued in the United States are not intended to be quoted any Stock Exchange, which tends rather to be the rule in Great Brita Further, a system of retail selling of bonds and shares through dir solicitation of the investor is possible in the United States, where t “ bond houses ” have built up a great and costly organisation for t house-to-house sale of securities. Such a development has been sever hampered in Great Britain by the legal prohibition of “ share hawkin in the latest Companies Act.

2. *The Stock Exchange*

When a great number of individuals hold investments which are lega easily transferable and when, on the other hand, the number of su securities is very large and their aggregate value larger still, the necess for some organised market in which such securities can be bought a sold freely becomes clear. Without such a market it would be difficult dispose of the securities easily and this would hamper the process which large-scale modern industry can obtain the funds it needs—si the possession of securities which are not easily transferable increases risk to the investor and makes him less inclined to hold property of t particular kind.

The Stock Exchange has been the object of such fierce denunciation critics of the modern capitalistic system that it is essential to underst the true functions which it performs. A distinction is often drawn tween the utility of the Stock Exchange as an agency whereby securi are transferred between investors, a function which is regarded as “ le timate,” and the use of the Stock Exchange as an “ instrument of spe lation,” which is looked upon as a “ perversion ” of its true function. B in fact, speculation also involves acts of purchase and sale, indistinguisha rm from pure investment transactions in the first instance. And notives which lead investors to change their investments and those h lead to speculative purchases and sales are also not clearly disishable. But, apart from these obvious difficulties in the way of disinating against speculation, it has still to be proved that speculation be dispensed with, given the further circumstances that the future is own and that *anticipation* of the future course of events is inevitable. e realm of economic life, uncertainty as to the future takes the form icertainty as to the course *prices* will take, including, of course, the s of securities. The economic function of speculation, then, in so s it is concerned with the prices of Stock Exchange securities, is a fold one : it consists in adjusting the relative values of securities to nother at any given moment of time, and in adjusting the present of security prices to what, in the opinion of competent judges, will eir *future* price level. The first adjustment is made by selling " overd " securities and buying " undervalued " securities, with the result he price of the first kind of securities will fall and that of the second ise. The second adjustment is made either by selling securities or parir kinds or groups of securities when it is anticipated that the underforces at work will in any case produce a decline in the long run, or iying them when it is anticipated that the underlying forces at work produce a rise. But there is no guarantee, except such as are afforded e circumstance that opinion is not necessarily wholly one-sided, to nt the movements in question from being overdone. If and to the t that they are, the fluctuations in security prices are greater than t have been experienced if no speculation had taken place at all. f the market thinks the rise or the fall has been overdone, counterlation sets in which promotes a fall or a rise.

s one of the main functions of the modern financial press and of the ts of brokerage and financial houses to assemble and study the data which judgments can be formed as to the relative merits of securi- The main influences which affect the general level of security prices so known. Periods of rising prices, increasing production and emient, in a word, periods of good trade, are also periods in which ixed interest paying securities—the residual claimants to the profits lustry—rise in price because the dividends paid on such shares in- in amount. Periods of falling prices and bad trade mean falling for industrial shares and rising prices for fixed interest paying ties, in so far as their prices are not affected by the fear that times bad that the debtor will default. Superimposed upon these general nents are movements caused by the special circumstances, good or affecting particular industries or areas, and superimposed upon again are movements caused by the special circumstances of par- undertakings or governments.

the extent that the investor and the speculator must be familiar these general circumstances affecting the movement of security , and to the extent that these movements are predictable, one can nately speak of the scientific aspect of investment and speculation. eculation and investment remain an art and not a science because no an foretell the *magnitude* of the movements involved before they

actually take place. The reason must be clear. A fall in the long period ra
of interest, for instance, makes a paper security paying a fixed or certa
rate of return more valuable, but no one can say by how much mo
valuable it has “ really ” become. In 1928–9, when the United States w
experiencing the greatest Stock Exchange boom in its history, it w
argued, and quite legitimately argued, that the great growth of savings a
productivity justified the valuation of securities at a price which su
stantially reduced the yield on the market value. Whereas formerly s
curities sold at a price equal to “ ten years' purchase ” of the annual ear
ings, they ought now to sell at a much higher price. But how mu
higher ? In the end securities sold at prices equal in some cases to fi
or one hundred years' purchase, *i.e.* at prices which yielded only one
two per cent. on the market value ! Until the break came in the autumn
1929 these prices did not seem absurd, because there was no scienti
standard by which to measure what they *ought* to be worth and there w
only a general presumption that prices were going “ too high ” a
would sooner or later decline. When a sufficient number of people fina
believed this, they *did* decline. But no one could tell in advance *when* t
would happen.

Actual market movements may therefore become quite irrational
magnitude, whatever the original justification for a rise and a fall may ha
been. And a further circumstance is likely to add to the magnitude of t
movement in the *wrong* direction. Firstly, the professional speculator m
try to exploit the irrationality of the situation by taking part in it. Secu
ties may be selling above what he regards as their true value, but so lo
as the public is inclined to think that the rise will go on, it is safe to specul
on the side of the public. This drives the prices of securities up still mo
And further, the irrational attitude of the public prevents the rapid app
cation of the corrective—sales of the security made in the hope of pri
falling sufficiently to enable the shares so sold to be bought in at a pro
An excited upward-moving market is one in which “ bear ” sales
highly dangerous, and, consequently, are not made. Until an advanc
stage of the boom all the elements which should help to temper a
moderate it are absent. A market in which no one will sell but only b
—*i.e.* a “ bull-market ”—is top-heavy and in the end leads to an equa
top-heavy “ bear ” market in which no one will buy but everyone is w
ing to sell.

Thus speculation is necessary, but its manifestations—even where th
is no attempt at deliberate manipulations of opinion by false rumou
“ pool ” operations and other devices intended to excite purchases
sales—are not always of the kind required in order that the econo
functions which it is supposed to subserve shall be adequately carr
out. And, in so far as the case against speculation is carried from
economic to the moral plane, the criticisms levelled against it are larg
justified. It cannot be denied that the hope of getting rich quickly
speculation generates a tone of life which is inimical to the developm
of those habits of mind and of conduct which are necessary if men a
women are to be content with the rewards which steady work a
application to the routine of economic life offer them.

3. *Aspects of Company Finance*

any of the problems of company finance (or corporation finance, to he American equivalent) arise out of the very special characteristics e joint stock company or corporation. As usually put in economic ture, the special characteristic of the joint stock company is that it its an individual to spread his risks in many directions, by a rela- y small investment in each special direction, but yet allows by a com- ion of sums, each relatively small, a great accumulation for each al purpose to be achieved. But this is only *one* of the special advan- of the joint stock company form. In addition, this form permits of elasticity not only as regards the *amount* which the individual con- tes, but also as regards the manner in which it is contributed. As nalysis of the various kinds of securities dealt in on the Stock Ex- ge showed, the individual may contribute capital in a form which es prior rights or in a form which carries residual rights. We may his in a somewhat different way by saying that the individual in- r contributes both capital and risk-bearing, but the actual contribu- nay contain varying proportions of either : the only condition being he more risk carried, the higher the ultimate return must promise .

vertheless, the joint stock company, just because of the differing es of the contributions made by different investors, *i.e.* because of resence of different classes of rights, also carries with it, besides its advantages, certain disadvantages. When different rights are crys- d in the same structure, possibilities of divergence of interest exist, ll as possibilities of co-operation. So far as the joint stock company cerned, these divergencies express themselves in differences of st as regards both the form and the amount of the *capitalisation* of ncern. This requires explanation.

gally, the capital of a joint stock company consists only of the nt subscribed by the shareholders. The actual amount paid up may s than the amount which is authorised as the total capital, but er the paid up capital differs from the authorised capital or not, is a definite connection legally between shareholding and capital. om the economic point of view, the capital with which the concern is a much wider conception than this. Money advanced to the com- by creditors (debenture holders) is part of the capital with which it : so is the amount retained out of past profits—the Reserve Fund plus. In actual practice, at any moment a concern will owe certain ts to trade-creditors and may be borrowing from its bankers : mounts in effect constitute the floating debt of the enterprise. One es a word which will include the legal capital and the other per- t funds with which the enterprise really works. Such a word is the can phrase " capitalisation." We have now to see how the exist- f different interests in the concern may affect the form of the isation and its amount.

re are three considerations to be borne in mind in discussing this on : considerations of safety, control and profitability. The theory which the government of the joint stock company is built up is that of democratic liberalism : the Directors of a Company are assimilated the position of Members of a legislature elected by their constituents. fact, widespread voting rights in a company easily interfere with efficiency of its working. It is therefore possible to compromise : to g certain classes of rights priority, both as regards safety and security, p vided that in return these classes of rights are prepared to sacrifice p of the control of the enterprise. Each party desires some *quid pro quo* what it sacrifices, and each party can sacrifice something for what it sires. Hence the debenture or bondholder, and to a large extent the p ference shareholder, have no voting rights (though of course it is possi legally for them to possess them) except in circumstances where safety of the capital, or the security of the income, is at stake. Assent be required for re-organisation proposals : for proposals to increase volume of rights ranking prior to, or equally with his own, and so fo Those ultimately in control are willing to part with some rights in or to obtain that which is in some respects fundamental : a concentratio authority within the enterprise.

One of the reasons making for a large volume of secured and p rights will now have become clear. The form of capitalisation is influen by the desire not to divide control too much. But there is another rea which works in the same direction so far as the form of capitalisatio concerned. Apart from the desire not to share control, there is the de to add more to the earning capacity of the enterprise than is represen by the fixed interest or dividend which needs to be paid for the use of funds obtained. If, on its capitalisation as a whole, an enterprise is ea ing 10% net, whilst it need pay only 6% interest on its debentures a say, 7% dividend on its preference capital, the margin available for p ment of larger dividends on the ordinary or residual capital goes up. dividends to be expected upon ordinary shares depend, therefore, only upon the earning capacity of the enterprise as a unit, but also u the proportion of prior to residual capital. From the standpoint of holder of residual capital, it pays to increase the proportion of pr ranking capital, provided it does not mean sharing control, and provi also—an important element in practice—that the earnings as a whole reasonably stable. For if they are not, a large amount of fixed-inter bearing debt and capital may make dividends upon the residual ca more unstable than the earnings as a whole.

The manner in which the amount of the capitalisation is affected by existence of different rights can be seen from two illustrations. Firs on the creation of an enterprise a large variety of interests may co-ope and of these interests some at least may desire to see the capitalisa expand. A promoter who obtains liens on a number of enterprises w he then unifies into one legal entity and resells to the public, mak profit out of the difference between the buying and selling price w grows as that difference grows. If the financial interests concerned the issue of the new securities are paid in shares, again that is an influ making for an enlarged capital. Or again, a new concern is founde exploit a new patent or discovery. The inventor or patentee offers to shares instead of cash. Pressure making for increased capitalisatio again present, especially as it is exceedingly difficult to estimate wha ıgs of an enterprise of this kind will really turn out to be. No doubt ne of the functions of the financial press to warn the public against :apitalised enterprises. But in periods of speculative mania and ism, such warnings are notoriously disregarded.

4. *Some Relations between Finance and Economic Welfare*

ıe of the relations of Financial Operations to Economic Welfare are mperfectly understood, not only by the general public, but also by ısiness community.

stly, an individual can safeguard himself against loss by selling a ty to someone else, but if the enterprise issuing the security does rosper, the economic loss sustained through a misdirection of ı effort nevertheless persists. From the standpoint of economic e, the enterprise has wasted resources which might have been applied by another person in the same or some other direction. eal loss to society from the failure of the recent " crop " of artificial ɔncerns to yield a profit is the wastage of the human labour and nent which have built plant, etc., which will never be operated.

ɔndly, in so far as equipment and human labour continue to pro- ıs fruitfully as before, society as a whole suffers no loss even if the t values of the securities representing the nominal value of the ctive enterprises of the community undergo a decline, and society hole gains nothing if these securities *rise* in value. The real wealth of nited States was no greater as a result of the phenomenal rise in market values in 1928–9, and is no less because of the subsequent e : for the real wealth of a country consists of the stream of goods rvices which can be consumed, and not of the nominal value of the ties issued by the enterprises producing these goods and services. ılar individuals have been ruined by buying securities at too high a but losses such as these have in fact been compensated by the gains se who sold the securities at those prices : and no actual loss of any vas incurred by those who retained possession of their securities hout the period of rising prices and the period of subsequent fall. fects of the boom, if any, upon the real wealth of the United States een exerted in indirect ways : by over-stimulating construction in branches of industry : by encouraging, first, wasteful consumption ince the depression) over-anxious economy. But apart from in- s such as these no ultimate effect on material welfare was pro- As soon as this truth is realised, the depression itself will begin s away.

dly, because speculation is concerned with the *transfer* of securities, not " withdraw funds from productive use." The impression pre- ıat if funds were not used for speculation, the amount accruing for rcial or industrial purposes would increase *pro tanto*. But this is an Where *new* securities are bought with borrowed money, the pro- pass directly from the financial to the industrial circulation : the of a new steel works, for instance, when bought by speculators for e, is furnished by those speculators or those from whom they , irrespective of the motive leading to the purchase. Where existing securities are bought with borrowed money, the sellers of the securities are in a position to take up new capital issues or to employ t funds for any purpose they wish. If the sellers again invest in old securi the funds are simply transferred to a new set of sellers and so on. amount withdrawn from immediate productive use is simply the s changing hands at a particular moment, and this is much less than total amount borrowed for speculation over a given period of time. T if speculators have borrowed £100 millions in six months and on last day of the period £10 millions is the amount due to sellers, £10 millions is for the moment, but only for the moment, " withdraw The other £90 millions is still owing by speculators to lenders, but sellers of the £90 millions of securities bought by the use of these fu have really received the money. As the volume of speculation grows, " float," *i.e.* the sums due at any moment, also increases, but the exter which sums have been withdrawn from other uses, even tempora cannot be measured by the mere figure of outstanding loans to spe lators ; the proceeds of these loans, when transferred to sellers in excha for securities, have mainly gone back into the general circulation of fu

VIII. THE PROBLEMS OF PUBLIC FINANCE

The problems of public finance are complicated by the fact that social and economic welfare of a community is affected not only by amount which the State absorbs in taxation and by the manner in w that amount is collected, but by the way and the objects upon which revenue is expended. Thus, in addition to difficult questions relatin the best manner in which to raise a given revenue and problems rela to the desirable aggregate amount of taxation, there is also the prob of the purpose to which that revenue, when collected, can best be devo Taxation, in other words, affects welfare both by being collected f certain individuals and by being spent for the benefit of individual system of taxation yielding certain sums of money may be better or w than another system yielding an equal amount : one scheme of expendi may be adjudged to have better or worse effects than another. Bu order that final judgment may be passed, it is necessary to take revenue and expenditure into account. It is *prima facie* clear that a sys of public finance which levies taxes on the poorer sections of the c munity, and expends the funds so raised on ends largely benefiting richer sections of the community, is helping to redistribute the nati income in a less desirable way than a scheme of finance which taxes richer sections of the community and uses the proceeds in a way w largely benefits the poorer sections of the community : for money *money's worth*, added to the incomes of the poor adds more to material welfare than a similar sum (in money or kind) added to the come of the well-to-do. But there are obvious limits to the process o distribution, which come from the possibly deterrent effects of high t tion. These deterrent effects may be so serious as to outweigh any dire beneficial effects otherwise obtained. Enough has been said to show very complicated the problems of public finance are, when the ef both of taxation and of expenditure are taken into account.

ressions derived from the practice of Governments in the past have
an almost complete misunderstanding of the part which Govern-
expenditure plays in modern economic life. There still lingers the
hat Government expenditure is “ unproductive,” a view which is
llised in the old statement that economy in Government expendi-
nables money “ to fructify in the pockets of the taxpayer,” the
us implication being that if money is *not* allowed to fructify in this
net loss, equal to the amount spent by Government, results. But
a complete error. The difference between private expenditure and
nment expenditure is not a difference between something and
g, but between the production of one kind of thing and the pro-
n of another kind of thing. And it is by no means true that if
nment abstained from spending anything at all, then the national
e would remain the same in amount, however different the things
which it is spent. For if there were no expenditure upon public
services, education, police, roads, the provision of information,
is quite clear that the amount of production in the community
fall off. Taxpayers might have to pay a smaller amount in taxes,
e fund out of which taxes are paid would be so much less that the
unity would be very much less well-off than it is now. It is true that
are certain forms of Government expenditure which are unpro-
e in the economic sense. Expenditure upon armaments adds noth-
time of peace to the material well-being of the community, and in
f war, of course, is utilised for the destruction of the sources of well-
Part of the expenditure of modern Governments, again, is “ trans-
penditure,” *i.e.* payments to old-age pensioners or payment of
t upon the National Debt. Such expenditure adds nothing directly
productive resources of the nation, and therefore nothing to the
al Income, except in terms of money. But the indirect effect of
transfer expenditure ” may be very great. For the bulk of expen-
upon Debt Services accrues to the richer classes of society, and
lk of expenditure upon Pensions and Unemployment Payments
reat Britain) accrues to the poorer sections of the community.
istribution of well-being is affected by such payments in a most
way ; and in a modern State, in which the view is entertained that
er effective degree of equality is itself a good thing, the Budget
to be a *mere* question of raising the minimum expenditure in the
onvenient way. The Budget becomes an instrument of Social
ment whether, as in Great Britain, between the rich and the poor,
n other cases, between the urban population and the rural popula-
r, as in the case of Protective Duties, between Producers and
ners. The Budget, in other words, has ceased to conform to the
which it was true that any expenditure included in it was of a
and strictly unproductive kind. It has become part of the machin-
Social Reform on the one hand, and on the other, its growth is
an indication of the increased part which Government is called
play in economic life generally. The question whether a par-
service can be better performed by the State than by some other
is, to some extent, a question capable of expert determination.
vices which in some countries are left to private enterprise, such

as the provision of life insurance and railway transport, are in other ca
carried out by the State, and so the discussion of what it is “ natura
for the State to do and not to do is very likely to be biassed by the tra
tional or customary division obtaining in a particular country. How mu
the State should do in the way of Social Reform is again an is
upon which no finality can be reached. For the answer depends not o
upon the precise objects of social reform expenditure and their resu
but also upon the reactions of taxation upon production, and th
differ not only with the nature of the taxation imposed, but with
willingness of the taxpayer to pay taxes, which varies very much fr
time to time and from place to place.

The expenditure of a modern State is not, however, financed entir
by taxation. The aggregate revenue can be divided into (1) proceeds fr
State property; (2) proceeds from loans; (3) proceeds from the perfor
ance of specific services; (4) proceeds from charges for acts in which
element of service is contained; (5) proceeds from taxation; (6) proce
from penalties. Some of these sources of revenue are not closely dis
guishable in practice : thus, if the Post Office charges enough for
services it performs to gain a net revenue over and above the direct
of the service, it is in effect levying a tax : the process of imposing a
for stamping documents which validate proceedings important in
economic or social life of the community also partakes of the natur
taxation, whilst on the other hand, in return for taxes paid, the taxpa
does receive some benefit, although that benefit is not measurable exac
The purpose of taxation is, in fact, to meet the general charges of Gove
ment, and arises out of the circumstance that, in the absence of S
property yielding a sufficient income or State enterprises yieldin
sufficient profit, the only way of meeting the cost of Government is
some levy on the citizens which does not pretend to vary with the ben
received, but with some standard, more or less accurate as the case
be, of “ ability to pay.” Revenue from State property, owing to the alie
tion of rights in the past, is not usually of great importance in the mod
world : but proceeds from State enterprises (which, of course, inv
the possession of fixed property by the State) is becoming more
more important as public utility enterprises are taken over by pu
authorities of one kind or another. In both these cases, of course,
revenue gained is, in part or in whole, offset by expenditure on maintena
and operating, so that only the margin between revenue and expendi
is available for meeting the general charges on the Budget. The possib
of meeting the general costs of Government by means of loans is cle
limited ; in time of war expenses rise as well as loan-proceeds, an
time of peace a Government which attempts to meet general expendi
out of loans will find it impossible to raise loans except at constantly ri
rates of interest. The place of loans in public finance is broadly lim
to (1) war (and even here the purists would prefer heavier taxatio
larger loans) ; (2) borrowing for short periods in anticipation of no
revenue proceeds ; (3) productive purposes (more important in the ca
subsidiary Governments than in the case of the Central Government)
temporary exigencies destroying the budgetary equilibrium for the
being, other than war, such as the failure of the crops in a cou

ıdent upon agriculture. (There is one form of borrowing which in cted periods, War and Revolution, possesses great elasticity, the ate effects of which are, however, ruinous. That is borrowing by s of "inflation," *i.e.* an indefinite increase in the volume of paper y. In the end, however, inflation as an instrument of finance s down because the money issued becomes valueless, or almost so ess that it no longer pays to increase the quantity any further.)

e upshot of the previous discussion is that the State must necessarily pon the yield of taxation for the bulk of the revenue which it needs et its expenditure. This raises, in the first instance, the question of ıer it is possible to state in general terms how much taxation can be from a given community, or, in other words, whether it is possible e what the community's "taxable capacity" amounts to.

is is a task which has been frequently essayed in recent years, with y satisfactory results, and expert opinion is gradually coming round point of view that it is impossible to define, even approximately, the limits to taxable capacity are. The limit is reached when the effects" of taxation outweigh any good produced by the expendif the proceeds of that taxation. Now it is clear, in the first place, that n may differ as to what "bad effects" should be taken into ac-: and however these may be defined, two systems of taxation, ng an equal revenue, may produce different kinds and quantities of ffects. Not only so, but the badness of the effects, if any, varies not vith the volume and kind of taxation imposed, but with the opinions ained by the taxpayers as to the "equity" of the taxation. And ity" in these matters being largely, if not entirely, a matter of l expectation, of what people are used to and therefore regard as " it follows that given a change in this respect, a large measure of on may have approached the limit of capacity to a smaller degree smaller measure of taxation would have done, given no change in espect. Finally, as already hinted at previously, the effects of the on on material welfare cannot be finally weighed until the effects of penditure financed by the taxation have also been taken into ıt. Without going as far as some writers who describe the whole ot of "taxable capacity" as a myth, it is at any rate clear that it is sive and unsatisfactory concept, with no great bearing upon the cal issues at stake.

"bad effects" of taxation relate to the repercussions of taxation the taxpayer. Though it is habitual to speak of taxation as being ed upon persons (as in the case of income taxes) or upon things or odities (such as excise or customs duties), in the end, of course, all re paid by persons or institutions. The effect of taxation is to dise the production of the thing taxed, through alterations in the wilss of individuals who "really" pay the tax to produce those or to consume them. The important question then is, by how will the production of the thing taxed fall off?

nodern communities such as Great Britain a large part of the e is derived from the taxation of income, through income tax and ax, and of savings, through the imposition of estate, inheritance gacy duties. Moreover these taxes have a growing importance,

since they present very great technical advantages over other forms
taxation. They lend themselves easily to exemption, differentiation a
progression, and therefore fit in with the modern tendency to adj
taxation to differing degrees of ability to pay, and they finally possess t
great virtue that they leave the taxpayer free to pay them by varying
expenditure on other things without interfering, except to the extent t
his means are reduced in the aggregate, with the various possible dir
tions of expenditure. A discussion of how far, if at all, income tax a
death-duties affect the production of the things taxed, is of gr
practical importance. In other words, is the production of income a
of savings adversely affected, and if so, to what extent ?

The deterrent effect of a combination of high income tax rates and
high death duty rates is in current controversy rated very seriously. T
knowledge that a large fraction of what is earned will be taken away
income tax, it is argued, destroys people's incentive to earn, the fact t
earnings are less, and the net amount remaining after tax has been pa
reduces the *ability* to save, whilst the further fact that these savings w
in turn be taxed reduces the *willingness* to save. Economic life is t
doubly affected : by a reduction in the spirit of enterprise, and b
reduction in the available volume of capital.

So far as willingness to earn is concerned, there is something to be s
for the view that, in so far as the taxpayer desires to maintain a cert
standard of life, higher income taxes, so far from deterring him fr
working, make him work harder. And, similarly, in so far as an individ
desires to accumulate a given sum for the benefit of his descendants
higher rate of death duty encourages him to save more, so as to leave
same net amount. If his income, out of which the savings are made, f
off, he will rather cut off expenditure upon current consumption t
reduce the amount he saves. To the extent that considerations of the k
just outlined influence individuals subject to tax, the deterrent effect
such taxation is less than appears at first sight. But, it must be born
mind (*a*) that where the income is itself uncertain, the willingness to t
risks is diminished, for the gain is in any case uncertain and the deterr
effect of the tax has a more than proportionate influence ; (*b*) a large p
of the saving of the community is done by a small section of the taxpay
owing to the inequality of incomes, and represents " automatic " savi
i.e. the excess of income over a high but largely predetermined stand
of living. Taking these considerations into account, it is probable that
present scale of taxation is having a deterrent effect, but one which
probably less than is usually supposed.

The problem of deterrence is a different one from the problem of
cidence, *i.e.* as to who ultimately pays the tax. In the case of income
super-tax and taxes on inheritance, expert opinion is almost unanimou
in favour of the view that such taxes *cannot* be shifted and that the i
dence is on the payer of the tax, though the effects of such taxation r
be very wide. In the case of taxes on commodities, the question of de
rence and of incidence is more complicated. A tax on beer has deter
effects on its production and consumption, but the incidence of the
may be very complicated. The duty is levied in the first instance on
brewer, and he tries to " pass it on " to the consumer either by rais

price or lowering the quality or by employing both methods together.
) far as the *aggregate amount* spent upon beer is the same as before, the
le of the tax is borne by the consumer, but less beer is consumed. If
ame amount of beer is consumed as before, the whole of the tax is paid
e consumer, except in so far as, his total resources remaining the same,
rices of other things consumed by him fall because his demand for them
ss urgent than his demand for beer, in which case part of the tax is
ed on to the producers of these things. But if, in the effort to keep up
, brewers do not pass on the whole of the duty, *i.e.* do not raise the
of beer in proportion to the tax, they pay the duty. This makes brew-
ess profitable and tends to discourage as much production of beer in
ong run as could otherwise have taken place. Taxes upon commodi-
re borne by producers and consumers in the proportion to which each
is in a position to turn in other directions, *i.e.* to produce other
s or consume other things. The less easy it is for a producer to shift
roduction, and the easier the consumer finds it to alter his consump-
the more likely is it that the former will pay part of the tax, or, in
me cases, the whole of it. The more wedded the consumer to certain
of consumption, the more likely it is that he will pay the tax. The
t is that consumers tend to pay the whole of the tax on necessaries,
ot where the supply of such necessaries is highly competitive and
of the producers can be differentially treated. A tax upon wheat,
npanied by "Empire Free Trade," would not in all probability
to a rise in wheat prices proportionate to the tax, except in periods
the Empire harvests were deficient. As the above illustration al-
shows, such considerations are important, particularly in dealing
the effects of tariffs. The question of whether the "foreigner" can
ade to "pay" the tax depends upon the particular situation of
commodity : the more the market in question approaches the single
et for a commodity, *i.e.* the more dependent sellers are upon it, the
likely it is that part of the tax will be borne by producers ; the
sellers approach the position of having a monopoly of the com-
ty and the less dependent they are upon the particular market
sing the tax, the more likely is it that the local consumers will pay
hole or the greater part of the tax.

xes upon commodities suffer in general from one defect from which
upon income are exempt. They tend to fall with much greater pro-
nal effect upon the lower ranges of income than they do upon the
r ranges of income, because a larger proportion of a small income is
upon commodities than is normally the case with a large income,
ally if the taxed commodities are necessaries or quasi-conventional
saries, as they tend to be : for otherwise they do not yield a suffi-
y large revenue. Hence a tax system in which commodity taxes
large tends to favour the richer against the poorer sections of the
unity, and this would still be the case if the tax were a turnover tax
mmodities generally : for a larger proportion of the larger incomes
ed than is true of the smaller incomes. It is true that if it is desired
ract a certain amount of revenue out of the poorer classes of the
unity, it is easier to do so by means of commodity taxes than by
, say, of a poll tax or a tax upon wages, for the taxpayer is not, in

many cases, aware that he is paying the tax and therefore the collectio of a given revenue results in less *apparent* suffering. But it still remair true that, in order to make the richer sections of the community pay mor not only absolutely, but proportionately to their incomes, commodit taxes must be supplemented by other taxes, especially taxes upon ir comes and inheritances, in such a way as to make the tax system as whole progressive.

The distribution of taxation between different social classes is, in fac one of the most difficult of all the Social Problems of the day. It aris from the fact that the electorate includes the bulk of the adult populatio of the country, and is consequently inclined towards methods of expend ture which benefit the poorer section of the community to a greater e tent than the richer. The combined effect of progressive taxation and e penditure upon public health, education, non-contributory pensior grants-in-aid towards Unemployment Insurance and the like is towar diminishing the inequality of fortune. Critics see in these developmer not only a danger that, if the policy is pushed further, the burden taxation imposed on the richer sections of the community will becor excessive, but also grave moral and political dangers arising from t majority of the population being encouraged to get "something f nothing."

So far as the moral danger is concerned, a great deal turns upon t precise form which increased expenditure upon the Social Services tak No one is likely to be demoralised by expenditure which does not invol a direct monetary payment to the beneficiary, but merely takes the sha of improving his physical and intellectual environment. Even dir monetary payments, when they take the form of old-age pensions, c hardly be regarded as demoralising. It may be argued that, in the absen of such gratuitous payments, the workers would be encouraged to ma provision themselves for their old age. But whether their incomes a really large enough to enable them to do so, except by sacrificing imn diate enjoyment for themselves and their families, which are so la relatively to their resources that only the most far-seeing and best- among them will in part do so, is another matter. To sacrifice pres efficiency for the benefit of the future may, in any case, prove very b economics. It is true that direct pecuniary payments, where not coup with any responsibility at all, do involve definite moral risks. But way to prevent the risk from arising is to improve the economic envir ment by the elimination, as far as possible, of the causes of unempl ment, for it is under this head that the risk of demoralisation m definitely arises. In any case, it has still to be proved that the mo demoralisation arising from the "dole" is worse than the demorali tion arising from mere lack of work and the decline of personal efficie and self-respect which accompany long spells of unemployment, acc tuated, as these would be in the absence of a system of relief, by und feeding and physical deterioration of the most pronounced kind. balance, even the payments under the Unemployment Insurance Scher have done more good than harm to the bulk of the recipients.

Moreover, if the problem is looked at with British conditions parti larly in mind, the redistribution of well-being which accompar nditure upon the Social Services is accompanied to-day by another of redistribution which benefits in the main the well-to-do sections e community. So long as Great Britain possesses a National Debt inng an annual debt charge in the neighbourhood of £350 millions, ne is being redistributed to the bondholder, which, so long as prices nue to fall, represents an ever-growing volume of *real* income. Or, is usually put, the real burden of the National Debt has been rising. e it is a fixed payment, and since, in time of falling prices, the egate money income of the nation declines, the annual interest en represents a larger proportion of the latter. It is true that, as the est is paid out of taxation, the richer classes as a whole are paying hat they receive in interest, but this payment reduces their effective ibution to the general expenses of the community, other than the Charge. In discussions of the equity of the existing scheme of taxathis point is often overlooked, but it is obviously vital in attempting rive at a true picture of the present situation.

IX. FINANCE AND THE PROBLEM OF PRICES

e increase in the real burden of the National Debt through the fall e level of prices is only one aspect of a problem, the significance of h for the whole Financial Structure cannot be exaggerated.

is natural to think of the apparatus of production in concrete terms terms of goods and raw materials, and of plant and equipment, facs, ships and railways. But production has an abstract as well as a ete side. The whole of the material equipment of mankind has at noment a *balance sheet value* : investment at any moment involves a tion, in terms of money, of what is being *invested in*. It follows from hat changes in the value of money—alterations in what the pound dollar will buy—must affect the value of investments, whether these st of rights to income or property, or the actual property itself. In iod of falling prices, the value of property must fall, and therefore, re are prior and residual rights attaching to such property, the net of the residual rights must decline even faster than the value of the rty itself, for whatever the property yields is subject to a fixed tion. And similarly in periods of rising prices, the value of residual must rise faster than the rise of prices, because they are subject o a fixed deduction, the proportion of which to the total yield falls t total goes up. Hence rising and falling prices are among the most tant of the general factors which affect the process of investment e value of investments. Moreover, so long as men look to the future ll as to the present, the problems presented by rising and falling are inescapable.

e question thus naturally arises : can anything be done by conhuman effort to reduce the risks which are involved in this way ? are two main ways of possible escape.

e first lies in devising contractual forms which take account of posrice changes and allow for them in the contract itself. Thus it can reed upon between debtor and creditor that if prices rise, the al amount to be paid by the debtor shall go up, so as to give the creditor the *purchasing power* which he actually lent, not an amount c money which really is less than this. Or, if prices fall, the creditor is t receive a smaller amount in terms of money than he originally agreed t receive, so as not to force the debtor to pay over an *amount of purchasin power* greater than the amount he contracted to pay. The introduction c contracts such as these would involve agreement as to how changes i the value of money, *i.e.* changes in the price level, should be measure and a condition of success would be a widespread adoption of the prin ciple involved. For a debtor agreeing to pay more to his creditor in mone would be in a difficult position unless he in his turn were covered, *e.* insurance companies, agreeing to make out their policies in terms of fixed amount of purchasing power (not a fixed amount of money), coul not possibly do so unless their investments in turn covered them again the risks involved.

The alternative is to attack the problem frontally and attempt to st bilise the value of money itself. But to achieve this, even partially, requir an instrument of stabilisation, and the vital issue of the moment whether it is possible to utilise the powers of the Central Banks for th purpose. In the modern world, the ultimate basis of the moneta system, gold, no longer circulates as coin, but is kept in the vaults of t Central Banks as part cover of the actual circulating medium, wheth notes or deposits. Subject to the requirements of the law, it is possib for the Banks to hold more or less gold against a given volume of pu chasing power ; or what is the same thing, with a given amount of go at their command, they can vary the amount of purchasing power issu against it. They can increase the amount of purchasing power outstan ing either by lending more freely, or buying securities more freely, or bo lending and buying more simultaneously. The problem of stabilising t purchasing power of money is, then, the problem of so varying t quantity of purchasing power issued directly or indirectly by the Banki System as to keep its value approximately constant in terms of an ind number of prices : increasing the volume if the index number falls, d creasing the volume as the index number rises. To carry out this poli even approximately, however, requires a considerable degree of c operation, at least between the Central Banks of the more importa money markets : and as no attempt has ever been made to carry out su a policy, it is impossible to say what success would attend an effort to so. The probability is that by means of it a much larger degree of stabil could be imparted to prices, even if absolute stability were to remain scientific ideal, impossible of practical realisation.

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MODERN THEORIES AND FORMS OF INDUSTRIAL ORGANISATION

By

G. D. H. COLE

SYNOPSIS

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ODERN THEORIES AND FORMS OF INDUSTRIAL ORGANISATION

form of economic and industrial organisation under which we)-day is commonly called Capitalism. It is not a rigid or a clearly d system. No one person or school of thought planned it, or even ht of it as a system before it began to develop. It is impossible to say precisely it arose, or from what period we should date the beginning capitalist era. For some of its features came into existence long others; and many are but developments or modifications of es belonging to earlier forms of economic organisation.

ertheless, we have all a fairly clear idea of what capitalism means, form in which it exists in the world to-day. Its distinguishing es are, first and foremost, the direction of productive effort by scale business organisations, owned by a multitude of private duals the vast mass of whom play no part at all in the active conduct enterprises in which their money is invested; and, secondly, the ice of a huge class of labourers who work for a wage or salary and as such, no part in the ownership either of the instruments with they work, or of the goods which they help to produce. This e between the functions of labour and ownership is the most teristic mark of modern capitalist organisation.

s, of course, is not to say either that the owner of capital does no or that the labourer is necessarily a propertyless proletarian. Many s of capital work hard and well; and many labourers nowadays s invested property on a small scale—even more in the United of America than in Great Britain. There is not even a sharp and e line of division between the owning and labouring classes—they into each other. The point is not that owners are idle or workmen te, but that there is, under capitalism, no necessary connexion n the separate functions of ownership and work.

trast the situation to-day with that of more primitive types of nic Society. It is commonly a characteristic of less developed nic systems that most workers own both their tools and their t, and live by selling what they have produced, where they do not consuming it directly, as many peasants do to a large extent. On ner hand, everywhere the modern workman lives by selling his He cannot sell his product, both because he does not own it, and e its nature is such that he cannot possibly own it under modern ons. In a sense, he has no product, and makes nothing. He only rates with a multitude of other workers by hand and brain in g a product which is essentially the collective work of a complex ensive economic group. Nor can he own his tools; for the simple ools of the primitive craftsman have been developed into vast power-driven machines far beyond the power of the individual worker own, and in most cases beyond the power even of the individual capitali Men must work together to create a modern product ; and men must cl together to buy the modern instruments of production.

There is no reason, in the nature of things, why the same groups persons should not join together both to produce and to own the instr ments of production. This has always been the ideal of those who, fr the days of the Christian Socialists of 1848, have put forward the ideal Producers' Co-operation as the means of resolving our industrial d harmonies. But, after a century of endeavour, Producers' Co-operati has achieved but little, though, in Europe, as we shall see later, the qu different movement of Consumers' Co-operation has achieved a gr deal. There are a number of Co-operative Societies of producers at w to-day, both in Great Britain and in continental countries, and a few America ; but their entire product is but an insignificant fraction of output of capitalist industry. Their efforts, moreover, have been mai confined to industries which do not call for much capital equipment, su as boot-making and tailoring ; and, even so, they have usually been co pelled to go outside their own working membership in order to raise sums required. The ordinary workman to-day does not possess enou capital to provide the means for his own employment ; and, even where does, he is usually not in a position to take the heavy risk of embarkin all in a producers' co-operative enterprise which may fail, and sweep aw the painful savings of a lifetime. It is usually sound business for the wo man, if he has saved money, to invest it in something widely differ from the business in which he is employed. He cannot afford to risk b his labour and his savings in the same enterprise, liable to the sa uncertainties : the sound principle for him, as for many other classes investor, is that of spreading his risks.

It is, then, impossible under modern conditions for the groups producers and the groups of owners who are required for the conduc modern business to coincide. This would not happen even if the work became much richer and the gulf between rich and poor much narrow American economists sometimes look forward to a day when capital will have been completely " democratised," and the ownership of mod large-scale business will be entirely in the hands of small investors w are also workers by hand and brain in the various enterprises which t own. I see no sign of the actual approach of this hundred per c American paradise ; but even if it did come it is safe to predict that dualism of labour and ownership would not be removed. Each workm might own shares ; but he would not own them mainly in the business which he worked. Owners and labourers would have come to be the sa people ; but ownership and labour would continue to be two quite dist and separately exercised functions. There is a very strong tendency modern industry to tear these two functions apart : there is almost n to bring them together where they have once been sundered.

e typical form of capitalist structure in modern business is the joint company or corporation, in which usually many shareholders or iolders contribute to provide capital for the carrying on of a complex prise employing wage-labour. Every decade and every year this d of business organisation becomes more pervasive. It arose first as a means of conducting certain quite exceptional types of enter- such as foreign trade with remote countries, or the exploitation of patent or monopoly. It was then applied to certain types of public e undertaking—to the supply of gas and water, and the building of and, later, railways. Adam Smith, writing in the latter part of the enth century, regarded it as suitable only for such services as could duced largely to routine, and called for no special qualities of ive or enterprise. The economist M'Culloch, writing more than century later, echoed this judgment. In the first half of the nine- century, joint stock companies, save for certain narrow purposes, still looked at askance. Limited liability, the foundation of modern tock company law, was granted generally in Great Britain only in Thereafter, joint stock organisation went ahead by leaps and s. In the past three-quarters of a century the joint stock company nquered the world.

reover, States, which so long obstructed its progress, now do all an to help it. The private company, limited to fifty shareholders and fering its shares for public subscription, were first recognised as a te type in 1907 under British law. The result was twofold. In the lace it became easy to convert family businesses, small productive ns, even small retail shops, into companies; and this has been done. And secondly, the new law made possible an enormous of subsidiary companies owned and controlled by the great joint concerns, but not subject to the same conditions in respect of ity. To-day in Great Britain the vast majority of the joint stock nies on the register are private companies.

ourse, even so, by no means all business has assumed a joint stock and many private companies continue to be actually managed by s who are also the principal owners of their shares or by partner- differing in form according to each country's legal code. But a increased proportion of the total business activity of the nation conducted by joint stock concerns with numerous bodies of share- s, under the actual management of salaried officers who may, or ot, hold shares in them, but whose holding of shares or stock is in e wholly irrelevant to their managerial function. Not only labour nership, but also management and ownership, tend to become d. The typical administrator of modern business is not an owner, nself an employee.

does not mean that he is governed by the will of the stock- or lders. The typical shareholder in modern industry, following the principle of spreading his risks, owns holdings in a large number of t business undertakings. He is not in a position, and he does not understand the detailed working of these various undertakings, or, save under quite exceptional conditions, to control in any way the policy or administration. Only when something goes very seriously wro with a business does the typical shareholder usually make his appearan as anything other than the passive recipient of a policy laid down by t directors.

These directors are, indeed, in theory the shareholders' appointe But hardly more than in theory. A contested election for a board directors is an extreme rarity ; and, in practice, the directorate usual recruits itself by co-option or by a policy of representation of vital important interests. In some concerns, the directors count hardly mo than the shareholders in the real conduct of the business ; and the effecti control has passed almost wholly into the hands of the salaried manage In others, the directors count ; but in large businesses they tend to cou rather as controllers of ultimate financial policy than as administrators technical controllers of production, and the productive control has pass into the hands of salaried managers who have little or no connection wi the ownership of the business.

There is accordingly a sharp divergence between the theory and t practice of modern business organisation. In theory, the joint sto company is not a democracy—for it gives not one man, but one sha one vote in its deliberations—but at least a polity in which all sharehold have a voice proportionate to their holdings. In practice, it is nothing the sort ; for the main body of shareholders are far too scattered, t shifting and too little acquainted with the working of the businesses which their holdings lie to make any effective use of their nominal voti power. Of course, even so a few big shareholders may exert a domina influence ; and this very commonly happens where one company hol directly or through nominees, shares in another. But where there is important shareholding of this sort and no small group of big sharehold dominating the rest, the body of shareholders hardly counts at all. T directors are, indeed, there to serve the financial interest of the wh group of owners and doubtless do their best to make the business success. But in most companies the great majority of the sharehold have really no control, and in some the whole body of sharehold scarcely matters from the standpoint of policy.

Thus it comes about that most of the owners of modern indus neither possess nor desire any say in its control, and that a small numb of great owners or administrators of large-scale business controls hu accumulations of capital belonging to other people. Probably the own ship of modern industry is becoming more widely diffused ; but this do not prevent its control from becoming every year more closely conce trated.

Nor does this concentration stop short at the single business. As have seen, there has been of late years a very rapid growth of subsidia companies controlled by the big business concerns. Most big producti concerns, such as Vickers, or The General Electric Co., or Unilever, ha under them a host of subsidiaries, over whose policy they exercise, in t last resort, a complete control. There is further concentration throu the method of interlocking directorates, which often link up several companies into a group following a common policy ; and there are holdi anies, whose sole function is to unify the policy and pool the profits number of nominally separate businesses under their control. erns of this sort shade off into trusts, combines, cartels and other s of trading association covering an even wider field, and bringing varying degrees of unification over whole trades or classes of uction. And we are now beginning to experience a still further e of consolidation, where—as in the new Coal Mines Act of 1930 in Britain, or the Federal Farm Act of the United States—the State venes to bring about a compulsory unification of policy over an entire try or service.

is description is not meant to imply a hostile criticism of the tendency ds consolidation. That tendency is indeed inevitable and, on the , salutary under modern conditions of production and sale. The of production and the capital equipment necessary for efficient e are now in many industries so large, and the results of purely ulated competitive production and sale so liable to be uneconomic isastrous, that businesses are compelled to frame a combined policy State to do it for them in their default. The single business can no pursue—in the major industries, at least—an independent career opt a purely autonomous policy without any co-ordination with in the same line of production. The day of competitive *laissez-faire* national borders is over. If it is not ended by action of the State, it ogated by the directors of industry on their own behalf.

result of these changed conditions is, as we have seen, a divorce en ownership and administration, as well as between ownership and . The three functions become more and more sharply differen- ; and the process of differentiation brings with it new problems of n. Many people are disposed to look back with regret to the day the master-craftsman, owning his own instruments of production orking in his shop alongside his journeyman, was at once owner, er and artificer, and when the workman had, if not an assurance, at reasonable hope of becoming a master-craftsman in his turn. system never existed in its entirety at any period in the past, and supposes that anything like it can be ever restored, under the d technical conditions of modern production; but many are d to wonder whether we have made the best of these new condi- ither from the human or from the economic standpoint.

first the position of the stock- or shareholder: he owns the ss, but, normally, his interest in it is strictly limited to its capacity him an income (or, in some cases, a capital appreciation) on his nent. He supplies the money to equip the business, but there his function ends. For the rest he is merely a passive recipient of . But, as owner, he preserves his legal right to any profits which the s may make. Surplus earnings (if there are any) belong to him and he managers or workers who actually conduct the affair. It is true consideration of his claim to the profits, he also takes a risk. y lose the money which he has invested. But, under modern con- of limited liability, this is all he can lose. He can no longer, artner in a private concern, be made liable in all his fortune for ts of the business. Limited liability is a clear recognition by

the State of the purely passive part which the ordinary investor n
plays.

The question is : " Has the investor, in ceasing to be an active age
forfeited his claim to receive the residuary profits ? " Many actual
vestors have voluntarily given up this claim in return for a greater securi
They take up debentures (which are legally loans and not part of
capital of the business) and accept a fixed rate of interest instead of a va
able profit. Or they invest in State or municipal or semi-public securit
similarly carrying a fixed rate with greater security. Even the preferen
shareholder, while he is in form part-owner of the business, is often c
franchised and usually surrenders his claim to share in the residuary p
fits. His passive rôle, as a mere investor looking for a return in mo
but not interesting himself in the conduct of the business, is explic
recognised. And, in the total investment of the community, the prop
tion of gilt-edged securities, debentures and preference shares bearin
limited interest tends to grow in relation to the magnitude of the ordin
capital or common stock. It is quite possible that, in some industries
services, the ordinary share will before long totally disappear and all
capital be provided at fixed or limited rates of interest or dividend.

Moreover, in certain types of business the private investor is e
ceasing to be called upon to provide new capital by any volition of
own. In prosperous times in Great Britain most of the new capital nee
by established industries tends to be provided by the accumulation
reserve funds out of the current profits. The entire amount of profi
not distributed in dividends : a substantial part is reserved in orde
provide for the expansion of the business. These reserved profits,
course, become part of the property of the shareholders and are re
sented in an enhanced value of the shares, or in new bonus shares iss
against them. But the process of investment ceases to be a voluntary
of the shareholder and is decided for him by those who control busi
policy. To the extent to which this occurs the shareholder loses his
remaining positive function and becomes a mere claimant to inco
wholly without constructive part in the creation of wealth.

Under these conditions even those who would repudiate any desi
attack the " rights of property " sometimes suggest that the rights of
shareholder need re-defining in relation to his changed status. There a
demands for the limitation of profits, for a sharing in profits, as of ri
by the administrators and labourers who do the actual work of indus
for a conversion of the shareholder into a *rentier*, having only a fixe
limited claim to a share in the product. The reply on the sharehol
behalf is that he still bears the risks and that someone must bear th
But how if, in a particular industry or service, the risk can be limite
even eliminated ? There is practically no risk to-day in holding shar
the Bank of England or the big joint stock banks ; and in such pu
utility services as electric supply there is growing up a type of S
guaranteed capital from which risks have been practically elimina
Large risks, of course, still remain in ordinary industries ; but whe
risks are diminished the shareholder's claim to take the residuary p
is proportionately weakened.

Suppose the community adopted a collectivist system this tend

be carried to its logical conclusion. The State would raise indus-
apital or take it over from its present owners, and would pay a
nterest for its use (reducing the claims, if it thought fit, by taxation
interest or of inheritance). The State would take the risks of indus-
d would, presumably, do all it could to reduce them by " spread-
or would pass them on to the consumer through its control over
. The owners of industry would become pure *rentiers*, like the pre-
olders of national or municipal debt. We are still far from a collec-
system ; but there can be no doubt that in Great Britain industry
een moving fairly rapidly towards such a system. The creation of
odies as the Central Electricity Board (by a Conservative govern-
is a clear sign of this tendency at work.

decline of the shareholder as an active partner in business enter-
ends to raise the status of the industrial manager and administrator.
lass has become of late years far more articulate and conscious of its
xistence ; and it has tended, in some degree, to modify its attitude
sequence of the change. The managers of industry are less purely
rvants of the shareholders and more the servants of industry than
vere a generation ago. This is certainly a hopeful development. It
to give the managers a broader and more humane outlook on the
ms of industry, decreases their feeling of being at war against the
s as representatives of the money-power, and helps to develop in
a code of professional behaviour and public service. It would be
to stress too much the extent of this change of attitude ; but no
able person will deny that it exists in some degree. The power of
nagers of industry has greatly increased ; and with more power
n some degree, a keener and finer sense of responsibility. For there
no real responsibility without power.

THE WORKERS UNDER CAPITALISM

rein lies the true seriousness of the workman's position. For he
l no recognised powers or rights in the conduct of industry. He
deed through his Trade Union exert a considerable influence on
y in which industry is conducted ; and in occupations where Trade
sm is strong he may have in fact a considerable negative authority
ver to veto or hamper the policy of the management. But this power
s chiefly negative, and is not recognised or sanctioned either by
by the customary view of the workman's rights. Consequently,
empt is made, save sporadically here and there, to enlist the work-
positive co-operation in promoting economic efficiency. He is not
d as a partner in the business, or as having any right to a share in
ction of its policy. Under these conditions he cannot be expected
much responsibility for making his industry as successful and
as possible, or to use his power in a responsible manner. He is
n consulted only when the management wants to cajole him into
omething up—into accepting a wage-reduction, for example, or
to the abrogation of some cherished rule or method of work ;
response is, naturally enough, most often merely an assertion of
re to get as much as he can out of industry without feeling

himself in any way responsible for doing his best to increase its abi
to pay.

The question here is : What can be done to enlist the great power t
now resides in the workers' hands on the side of productive efficiency
order to raise the national dividend and the workers' standards of li
Many answers have been put forward. In Great Britain the Whi
scheme of Joint Industrial Councils, launched at the close of the War,
a half-hearted attempt to recognise the workers' claim to a voice in
control of industry without any fundamental alteration in the econo
system. It broke down in most cases because it did not really give
worker any power at all. The final decision remained as firmly as eve
the hands of the employer or manager. The Whitley Council could
only by mutual consent : it could carry no proposal against opposi
from either side. And in the works, the employer or the manager
had the right to say what should be done and the workers had not
may be said that this is inevitable, for as long as industry is conduc
on capitalist lines. Perhaps it is inevitable ; but even so it was certa
fatal to the serene hopes of some of those who sponsored the Whi
scheme. And there have been many schemes similar to British " W
leyism " in the United States.

Apart from Whitleyism some employers put their faith in W
Councils and the development of consultative machinery in the fac
itself. But the same difficulty arises. The management have the righ
give orders ; and the workmen have not. The Works Council can ope
only where agreement can be secured ; and in default of agreement
employer or manager still decides what is to be done. What is someti
called " joint control " is really unworkable. There must be someb
who has the last word.

I do not mean to suggest that Works Councils or Whitley Councils
necessarily bad. They may be good in their effects from the standp
of both management and workers. But they do not and cannot, under
isting conditions, give the workmen any real or recognised control
industrial policy. The workmen remain a class devoid of recognised p
or responsibility—a body external to the control of industry, w
rights are limited in the last resort to the terms of the wage-contract.

Of course, many people regard this limitation as inevitable, on
ground that it is essential to the success of the capitalist system and
no workable alternative to capitalism has yet been advanced. But any
who takes this view has to recognise that the limitation interferes
ously with the working of the capitalist system, because it engende
constant friction which cannot be conducive to efficient produc
The workmen, or a large number of them, do undoubtedly resent
exclusion from a recognised share in the determination of indus
policy. This does weaken their sense of responsibility for doing the
work they can, and does create discontent and friction in the worksh
and an attitude hostile to the development of co-operative measure
the improvement of industry and its adaptation to changing needs. M
economists attribute a great deal of the unemployment of recent
to the undue rigidity of our economic system ; and the lack of a co-op
tive spirit between the administrators and the ordinary worker

ry is assuredly a powerful factor in causing this rigidity. It is
t impossible in most industries to get employers and workers to
together for the dispassionate consideration of changing needs
chnological conditions.

circumstances described above mean that the capitalist system
to-day in a fashion widely different from that of even a generation
nd still more differently from the system as seen by the great
al economists when they formulated the theories which still largely
ate modern economic thinking. The classical economists thought
employer as an individual operating largely with his own capital,
ot as a huge corporation owned by many thousands of investors
ignorant of its working, and administered mainly by salaried
s uncertain of their relative duties to the shareholders, to the
rs employed, and to the industry itself. They thought of the work-
s an isolated individual seeking employment, and not as a member
owerful Trade Union, possessing in addition a parliamentary vote,
-provided education, and a desire to think for himself and to adapt
organisation to meet his needs. The idea that the workman should
n the determination of economic policy barely entered into their
; but neither, despite Robert Owen and a few other prophets, had
ose days seriously entered the heads of the workmen themselves.
lays it has ; and this fact makes a vital difference. For men who
otes, education and Trade Unions to back their demands simply
be managed by the same methods as the voteless and disorganised
rians of a century ago.

use of these changes, and of the growth in the organised political
dustrial power of the working classes, we live in a world that is full
ects of economic reconstruction. And these projects have to be
eriously even by their opponents ; for throughout the Old World
they command vigorous support among classes powerful enough,
as they will, to shake the entire legal and factual foundation on
the capitalist system rests. The New World of America is indeed
gely immune from this menace or hope, as it may be regarded ; for
w World has been so far, on the whole, too busy discovering new
es and improvising methods for their exploitation to have leisure
down and cast a critical eye upon itself. There is Socialism in
a ; but there has not been hitherto the widespread sense of dis-
and maladjustment that are necessary in order to convert Social-
m a mere theory into a practical and positive challenge to things
are. This may come in America, and come soon if the growth of
l prosperity suffers any abiding check. In the Old World it has
ready ; and the problems which it arouses need to be faced in the
ate future.

broadest of all these questions is whether, in the countries of
n Europe, the capitalist system is to survive or not. Ranged against
inuance are Socialists of many varying schools of thought, who have
most part successfully constituted themselves the leaders of the
odies of organised working-class opinion. The Trade Unions may
in any full sense, Socialist ; but they certainly respond to Socialist
ip. Every developed European country possesses a powerful

Socialist or Labour Party, committed definitely to the advocacy of a ne industrial system, and commanding the general support of the mai body of Trade Unionists. Most of these parties are, of course, evolutionar in their ideas, and do not, like the Communists, contemplate a sudde and immediate overthrow of capitalism and the complete substitution a Socialist system at a single blow. But they do, one and all, concei themselves as working for the gradual and reasonably rapid transform tion of the economic system from a capitalist to a Socialist basis.

I have attempted to give a general picture of the essential features capitalist society ; and I must now attempt a similar general picture of th idea which the Socialists set up against it.

THE SOCIALIST ALTERNATIVE

Socialism, as a doctrine or plan of economic organisation, holds th the direction and control of industrial policy should be in the hand not of private owners of capital or their nominees, but of the communi itself. It urges the socialisation of the vital industries and services, as means to their collective control in the common interest. Of course, t community, like the private capitalists—and indeed to an even great extent—would have to act through agents. The whole people would no more able than the whole body of shareholders in a great mode enterprise to *manage* an industry. No less able either, one might ad for the thing is out of the question in either case. Nor could Parliamer lacking specialised competence and with a vast mass of other work to possibly administer industry itself, or keep a daily watch over its poli and working. It would be necessary, under Socialism as much as und large-scale capitalism, to entrust the actual management of industr enterprise to salaried experts, chosen for their specialised knowledge a ability in particular branches of the work.

Moreover, it would be necessary to set over these specialist manag of the actual operations of production other persons, correspondi roughly to the directors of a capitalist firm, who would deal with broad issues of policy and define with the advice of the experts the course to pursued. The difference would be that whereas the board of direct holds office and issues orders to the actual managers as the represen tive of the shareholders, the board of a nationalised or socialised conc would be there to represent the interests of the general public. T methods to be adopted in choosing these directors of socialised industr and services, and the question of the powers to be conferred upon the raise some of the most vital questions of Socialist policy.

For it is evident that no board or commission appointed to direc socialised service could be given absolute power. Take a further anal with the board of a capitalist company. The impotence of the main bo of shareholders in such a company may in practice give the director free hand in the direction of policy, including the fixing of dividends, allocation of sums to reserve, and the entire expenditure of the compan available resources. But their power is still not absolute ; for apart fr their reserved profits they cannot raise new capital except by persuadi the public to subscribe it. In a socialised industry or service, even if d were left unfettered in the same degree, it would clearly not be able t fresh capital except by appealing to some outside authority—preably in this case the State itself.

it the controllers of a socialised service would hardly be given as much er as the directors of private enterprises in practice possess. They d hardly be allowed to appeal to the public to subscribe fresh money, arrange their own allocations to reserve, or to embark on big new al expenditure even out of available resources, without the sanction me higher authority. For it is part of the Socialist doctrine that the opment of industry as a whole should proceed in accordance with dered plan, in order that the products of each service may be forthng in the right relation to demand, and the serious wastes and disortions that arise under the capitalist system avoided. That these s are serious no one who has followed the subsequent stock exchange ry of new flotations and issues of capital in recent years is likely to t. A very large part of the capital subscribed to new issues has been utely lost—a loss plainly reflected in the decline of the share values estion. It is part of the Socialist charge against the present system its chaotic methods of raising new capital result in large avoidable and in the development of industries out of relation to the effective nd for their products. Evidently then the Socialist policy involves sort of co-ordinated control over the supply of capital to different tries and undertakings, and this implies the existence of some sort thority to which the boards of particular industries wanting fresh al for development would have to submit their case.

e see, then, that the Socialist doctrine raises a number of distinct ems of industrial organisation. These are :

. The form of actual management and the methods of appointing managers.
. The form of the directing board or authority for each industry or erprise, and the methods by which it should be appointed ; and
. The form of the co-ordinating control of supreme policy, includsuch matters as the raising of fresh capital and the relative rates of elopment of different industries and services.

r are these all the vital problems. We can, at this stage, add at least hers of primary importance. They are :

. The relations to the management and to the directing bodies of actual workers employed in the various industries ; and
. The question of the prices to be charged and paid, both for the nmodities produced and for the labour engaged in their production.

ere is no reason to suppose that the methods of appointing the actual gers in socialised industries would differ widely from those already ce in large-scale capitalist enterprise. There would, of course, no be persons managing businesses solely because they were the sons r fathers ; but in many forms of large-scale business this particular f nepotism has already almost disappeared. Modern big business tries to find the most efficient managers it can ; and socialised servic would do the same as, say, a municipal tramway department or the Po Office already does. It is indeed to be hoped that the range of choice wou be widened by the greater facilities for higher education, irrespective the parents' means, which all Socialists wish to provide. But apart fro this there would be no great change, save that greater stress would pr bably be laid on skill in the handling of men by enlisting their co-oper tion, rather than by driving them on under the impulse of fear. There no reason to suppose that socialisation of any industry would mean great change in its managerial personnel.

The remaining questions present far more difficulty, and to some exte Socialists hold varying views about them. This does not necessarily imp contradiction ; for there is really no reason why a Socialist system shou be uniform over all industries. There is room under Socialism, as und Capitalism, for diversity of structure and organisation. No sensible pe son, Socialist or not, would want to organise all industries and servic in just the same way.

Broadly speaking, there are two different conceptions of the type directing body suitable for a socialised enterprise. One of these wou make the directing body representative, while the other would have t members of it chosen as individuals, purely on the score of their person qualities and capacities. Thus, in the scheme for the nationalisation the coal mines put forward by the Miners' Federation of Great Brita shortly after the War, it was proposed to entrust the direction of the i dustry to a representative Mining Council half nominated by the Mine Federation and half to represent other interests and groups concern On the other hand, in the scheme put forward by the Labour Party a the Miners' Federation before the Samuel Commission in 1925, it seem to be contemplated that the members of the supreme directing bo would be chosen as individuals and not as representatives ; and t course has actually been followed in setting up the new Central Elect city Board and appears to be intended in the case of the proposed n public traffic combine for Greater London.

It is not impossible to unite these two principles in one and the sa body ; but they are broadly distinct, and it is doubtful if the attempt combine them in at all equal proportions on the same body would res in efficient control. Most Socialists seem to believe that, for the immedi future at any rate, the non-representative type of body is to be preferre but some hold that in process of time non-representative may give v to representative forms of control. This issue is clearly bound up w that of the relation of the workers employed to the control of the ind tries in which they work ; and I shall say no more of it now, as I shall h to come back to it in that connexion.

Of course, a representative body might represent other interests groups than the workers engaged in the service. It might, for examp be so constituted as to represent the different types of consumers of products in question. But, despite the success of the Consumers' operative Movement, most Socialists seem to hold that any attempt imitate its organisation in relation to each separate industry and serv would be ineffective and would lead to inexpert control. It is one thing ge body of consumers to unite in order to choose a management nittee to control a local general store, or even for such stores to unite e control of a vast national Co-operative Wholesale Society. It would uite another to attempt to constitute a Coal Consumers' Council to t the fortunes of the coal trade alone and to reduplicate the special nisation for each socialised industry. There is much to be said for a sumers' Council for each industry, meeting occasionally and exerting ical function in relation to the actual directing body. But such Coun-ould hardly be more than advisory and would tend to lose their value itics if they were actually involved in the direction of the industry.

ne third problem is that of the construction and broad control of y over a field wider than that of each single industry or service. Under ialised system there would presumably be separate directing bodies uch services as coal, electric supply, railway transport, road trans- and so on. But it would be clearly necessary to co-ordinate the con-over the whole group of services dealing with transport and power. , in the scheme presented by the British Labour Party to the uel Commission in 1925 it was proposed to constitute, in addition e separate directing body for each service, a central Power and Trans- Commission, with a general oversight of the policy of the entire . This was to be a non-representative body of persons chosen for individual qualities and capacities and entrusted by Parliament with powers of supervision and control. But even to such a body Parlia- clearly could not delegate all its power. It would have, while ridding of the day-to-day business of administration, to reserve to itself nal power of control over policy. The Commission would owe its rity to an Act of Parliament, and this Act would be at all times open endment. In addition, Parliament would presumably reserve to itself nal financial authority, and the right to disapprove orders or regula- issued by the Commission. The precise technique of this parliamen-ontrol would need to be worked out by a process of experiment; but are already enough Boards and Commissions actually exercising powers delegated to them by Parliament to give a fair idea of how lan would operate. We have already the Port of London Authority, entral Electricity Board and the British Broadcasting Corporation, nothing of various non-industrial Commissions exerting wide ad-trative powers, and on the American continent, the great public isation which controls the power-supply of Ontario.

is brings us to the question of methods of appointment. Unless the entative principle is adopted, it seems clear that the various ing Boards and Commissions would have to be appointed by the nment. This is the existing practice, when such bodies exist; and usible alternative appears to be open.

see, then, that the modern Socialist idea of economic organisation ot involve the conduct of socialised industries directly by Govern-departments, on the analogy of the Post Office, or by Civil Servants ordinary sense. We have rather a vision of a number of largely in-dent boards or commissions, differing from the directing bodies of scale capitalist concerns mainly in that their responsibility is not to tered group of private shareholders, but to Parliament and to the public as a whole, and further in that their several activities are co-ordinated over a wide field in order to provide for their harmonious development within a general economic scheme.

WORKERS' CONTROL

What is the place in this imagined structure of the ordinary worker employed in the various services? How would their position unde socialisation differ from their position in private industry to-day? I seems evident that they would have more security of employment an that there would be less shifting from employer to employer, or from on engagement to another. But security could not be absolute; for obviousl the volume of employment could not be kept stable and unchanging i each industry irrespective of technical alterations and of fluctuations i the volume of demand. Socialised industries would have to be left fre to expand or contract their relative demands for labour; and the Stat could not, as it does largely with the existing Civil Service, guarantee an absolute security of tenure.

But would the workers, while they were employed in any particula socialised industry, be admitted to a share in its control? That they shoul be was the persistent demand of the Guild Socialists, whose propagand strongly influenced Trade Union and Socialist thinking during and afte the War. The Guild Socialists, of whom I was one, stood for what the called "self-government in industry"; and this was really a combination in one phrase of two separate though related claims. In opposition t a now defunct and discredited "Collectivism," which proposed to han over socialised industries to ordinary Civil Service administration, th Guild Socialists urged the need of endowing industry as a whole, and eac industry in particular, with appropriate functional organisation. Th first demand has largely been met in the propaganda of post-war Socialism by insistence on the necessity of placing each socialised service unde a special board or commission. But the Guild Socialists urged, not onl that each industry should have its own government, but also that th government should be based on the direct representation of the ordinar workers upon the functional authority. They wanted the leadership industry to emerge from the will of the workers engaged in it, and not be imposed on each industry from without.

How far does this claim still stand? The Guild Socialist movemen having caused the leaders of Socialism to modify their policy so as to a cept the need for functional organisation, has now gone out of existen as a distinct organised affair; and the Trade Unions, which were large attracted by Guild Socialist propaganda in the years immediately aft the War, have mostly been too busy during the long depression with t defence of wages and conditions to have much energy left over for pre sing the demand for workers' control. Trade Unionism depends for i strength upon the prosperity, and derives its moods from the conditio of industry; and since the slump of 1921 circumstances have been high unfavourable to the growth of Guild Socialist doctrine or to any lar practical movement for the securing of "workers' control."

Nevertheless, the Guild Socialist theories have left a strong impressi

nd. On one of their two main points they have won over the main
y of Socialist opinion. The other is still open to debate, and is likely
ecome of practical importance only when one of two things occurs :
n trade revives and so restores the power of the Trade Unions, or
n the State takes over some great industry and has to face the problem
quipping it with a satisfactory form of government. Should either or
of these things happen, there is certain to be a recurrence of the de-
d for workers' control.

is, however, probable that the claim will be revived in a form different
that in which it was made by the Guild Socialists a decade ago.
y urged that the State should acquire the ownership of industry, but
ld hand over its administration, under a charter, to a Guild composed
e whole body of workers engaged in it. Thus the entire administra-
of the industry would be in the hands of persons chosen by those who
to work under them, and the conduct of economic enterprise would
ade as democratic as that of the political State is supposed to be. No
I think, now expects matters to fall out after this wise. The practical
lem is rather that of providing, within the framework of administra-
by a board or commission of the type suggested earlier in this essay,
utlet for the constructive co-operation of the ordinary employees,
gh the development of Workshop Committees, Works Councils, and
esentative bodies covering larger areas. This representative ma-
ery would probably have, in the first instance, only limited functions ;
an effort could be made gradually to delegate to it an increasing
nt of actual power over such matters as the detailed organisation of
in the factory, discipline, engagements, promotions and dismissals,
ll those matters which are of close and direct concern to the ordinary
er in his daily life. The Germans, with their Works Council Law,
already made a beginning of granting statutory authority to repre-
tive organisations of employees within the factory ; and without
tory powers a number of experiments have been made in the de-
ment of workshop machinery in both Great Britain and the United
s. Socialisation of industries would probably provide a fertile soil
e flourishing of such experiments on a more ambitious scale.

th and last among the major problems of socialised control, as de-
earlier in this essay, stands the question of wages and prices. It is
that when socialised industries are given an autonomous direction,
powers cannot extend to an unfettered control over the pricing of
products or over the wages and salaries to be paid to their em-
es. In the services already subject to some sort of State regulation,
exists machinery for the fixing or control of prices. The British
ay Rates Tribunal has power to fix maximum railway charges ;
here are similar powers in the case of both gas and electricity. On
ilways, wages also are subject to a measure of statutory regulation
the Railways Act of 1921 ; for though the National Railway Wages
has strictly no power to enforce its awards, they are in practice
y effective and observed. It seems safe to suggest that any exten-
f socialisation in the major industries would carry with it the crea-
oth of some special mechanism of price-control and of some body
lies to act as a court of appeal on questions of wages.

It has been necessary to present at some length this account of th
modern policy of Socialism for the nationalisation or socialisation of ir
dustries, because it largely modifies earlier conceptions and is still ver
imperfectly understood. As socialisation becomes more and more
question of immediate practical politics, the simple solutions of purel
propagandist days have to be discarded in favour of more complex an
carefully elaborated plans. The stress used to be laid mainly on the de
sirability of the State taking over the control of industry, without muc
reference to the actual methods of socialised administration or control
but as soon as socialisation is proposed as an immediate measure for ar
industry, such as coal mining, it becomes imperative to define precise
the type of administration that is to be set up.

RATIONALISATION

We have now set out, in broad contrast to each other, the existir
organisation of industry and the Socialist alternative. But there are,
course, persons who are satisfied with neither of these, and in particul
many who believe that the abuses of capitalism can be remedied witho
passing over to a Socialist system. The Socialist attack on capitalism
a form of economic organisation, as we have seen, concentrates large
on two points : on the economic waste and inefficiency inherent in
because of the lack of any coherent plan of social production, and on t
unsatisfactory and deadening situation of the worker. Can the gravam
of these charges be removed by amending capitalism without bringi
it to an end ?[1]

The current answer to the first of these problems is in terms
“ rationalisation.” There is a powerful movement aiming at the rationa
sation of industries and services under continued private ownersh
and control. This word “ Rationalisation ” has come prominently ir
use only during the past few years, first in Germany and then in oth
countries, as a name not for one thing alone, but for the unification ir
a single policy of a large number of pre-existing tendencies and ide
This makes “ rationalisation ” exceedingly difficult to define. It incluc
at least these elements :—

(1) An intensive application to industrial processes of the m
up-to-date technical methods of production, including a more dev
oped mechanisation of industry and the more rapid scrapping
obsolescent plant and machinery, as well as the more active purs
and encouragement of technical research.

(2) The standardisation and simplification of products and process
in order to cheapen production by eliminating unnecessary variet
of goods, and enabling the remaining types to be made in lar
quantities by methods of mass production.

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[1] It should be noted that I am not discussing the whole Socialist case,
only that part of it that relates to the actual organisation of industry. T
Socialists' most fundamental quarrel of all is, of course, with the present c
tribution of wealth ; but that, except incidentally, falls outside the scope of t
Article.

(3) The more scientific utilisation of labour, based both on simpli-
ation of processes, and on more accurate study of the conditions of
ork, by methods that used to pass under the name of "Scientific
anagement," and by newer methods associated with the growing
idy of Industrial Psychology.

(4) The aggregation of capital into larger units, and the establish-
ent of inclusive regulating bodies for whole industries, with the
rpose of regulating both production and prices, of concentrating
tput in the best equipped and most suitable factories, and of closing
wn "redundant" works in order to eliminate their competition.

(5) The adoption of more efficient methods both of buying materials
d requisites in bulk, and of marketing products through a central
ling agency, or by some similar method ; and

(6) The conclusion of international agreements for the definition of
rkets and spheres of influence with similar organisations in other
intries.

is, of course, unlikely that any one scheme of rationalisation will
ody all these features. Indeed, the development of the movement
ues a different course in different countries. In Germany it has
n up with the full encouragement, and sometimes the direct partici-
n, of the Government. In the United States, on the other hand, the
ence of Anti-Trust legislation has caused the main emphasis to be
publicly at least, rather on the standardisation and simplification of
esses and the more economic use of labour than on the regulation
tput and prices. And in Great Britain, where the State has in the
neither favoured capitalist combination nor legislated against it,
novement has grown up almost wholly apart from any element of
c regulation or control, such as exists in the German *Reich*.

viously, from at least two standpoints, the rationalisation movement
s dangers. It places in the hands of great capitalist combines a
power of restricting output and regulating prices ; and these powers
lainly capable of being used against the public interest. It is not
ul to see in the existence of strong combines among manufacturers
f the reasons why the relative prices of primary and manufactured
cts have changed of late years greatly to the disadvantage of the
ry producers. Secondly, the more scientific utilisation of labour
nean in practice that the workman is driven at an increasing pace
hat his work becomes more monotonous and more irksome. It is
ggested that this *must* be the result ; but it certainly may be, if the
em is regarded solely from the standpoint of reducing costs, without
or its human aspects.

the other hand, it is clearly to the advantage of the community that
ry shall be conducted as efficiently as possible, in order both to
se the need for long hours of work and to provide means of raising
andard of life. There is much waste in industrial processes, and
alisation is calculated to reduce this waste and to increase the
ctive capacity, and decrease the costs, of the industry that adopts
e trouble is that, under present conditions, the rationalised industry
n more likely to restrict production than to expand it, and so

likely to cause unemployment or at least most unlikely to cure it
Moreover, where national industrial groups are competing in the worl
market, their competition often prevents them from reducing hours o
labour or raising wages, and so, instead of lightening the labour of th
workers, actually makes it more intense than before.

Neither of these disadvantages, however, can fairly be made into a
argument against rationalisation itself, but only against abuses of it
The first points to the need for developing a new technique of socia
control. If capitalism is in future to be organised in great combines
approaching the position of monopolies, and regulating both prices an
the total volume of production, the State must clearly be equipped wit
means of preventing the abuse of these powers. This will have to be done
not by legislating against the existence of combines—a method whic
has always failed—but by taking authority to regulate their prices and t
veto, in case of need, their restrictive measures.

In the case of the workers the remedy is less easy to formulate. It i
likely to include the strengthening of codes of legislation regulatin
factory conditions, more drastic legal limitation of the hours of labou
and a readjustment—with support from the State—of the methods o
Trade Union bargaining. As changes are made, workshop by worksho
in the conditions of labour, with the introduction of new machines an
methods of production, the Trade Unions will need to do more of the
bargaining upon a workshop basis, and to have at their command exper
in Industrial Psychology and the technique of the new methods. Th
will involve the creation by them of stronger workshop machinery—
task in which the State might well help by the enactment of measures o
the lines of the German law establishing Works Councils on a compulso
basis.

Socialists, of course, while they may favour these methods for th
immediate future, will not rest satisfied with them. For the Socialist case
that the powers inseparable from the successful conduct of mode
rationalised industries are far too vast to be safely left in private hand
and that, accordingly, any industry to which they are appropriate h
already reached the stage at which socialisation in some form ought
be applied.

In Great Britain capitalist rationalisation, while it has been ve
widely discussed, has not yet in practice advanced very far. The ou
standing example of its actual working is the great firm, Imper
Chemical Industries, Ltd. Certain recent amalgamations in the coal a
steel trades, in Lancashire, for example, can be represented as part
measures of rationalisation; and the Coal Mines Act of 1930, with
establishment of compulsory organisations for the determination of ou
put and selling prices throughout the coalfields, marks the definite ent
of the State into the field in order both to further rationalisation and
establish some sort of public control over its working. But assured
neither coal nor steel can yet be described as a "rationalised" industr
and the Lancashire cotton trade, despite a vast effusion of words, is
further off the adoption of any co-ordinated form of organisation.
most industries British employers are very jealous of their individu
freedom and very unwilling, save under the pressure of desperate ne

urrender their powers into the hands of any general regulating body. is strongly individualistic temper, developed under the competitive ditions of the past, offers fierce resistance to measures of rationalised trol which have been far more readily accepted in Germany, and even France. Nevertheless, rationalisation is being slowly forced upon ish industry by the necessities of competition in the world markets, almost everyone nowadays at least pays lip-service to it. It represents outstanding attempt of our time to reconstruct capitalism in the light hanging methods of production and conditions of sale in the markets he world.

CO-PARTNERSHIP AND "WELFARE"

he second attempt to reconstruct capitalism is concerned rather with ting the charge that it makes labour unduly irksome and repugnant, does not enlist the co-operation of the worker in making production fficient as possible. One school of capitalist reformers puts much in industrial co-partnership and profit-sharing as means of giving worker a different attitude towards his job; while another, not essarily different in personnel, stresses rather the need for humanising improving the actual conditions of work, by means of "welfare" nisation and similar methods. Both these schools of thought agree the workman ought to be consulted more than he normally has in the past, and that an attempt must be made to enlist his loyalty to bind him to his work by something more than the mere "cash us" characteristic of to-day.

rojects of profit-sharing and co-partnership in capitalist business (as nct from the attempts at producers' co-operation mentioned earlier is Article) have a long and chequered history behind them. They go at least to the middle of the nineteenth century; and their number lways tended to grow at periods of acute industrial unrest. Yet, even ay, despite a somewhat rapid rate of increase in the years following War, the total number of schemes in force is not very large, and the e of them cover only a tiny fraction of the total employed population. is explained partly by the fact that the mortality among the schemes ed has always been very large, and partly by the failure to obtain foothold in the leading industries and services. Coal, steel, engin- g and cotton have in the main stood aloof from the movement; and, ed, the only industry in which profit-sharing applies to a large pro- on of the total personnel is the gas industry. Here quite exceptional itions exist. Profit-sharing was first introduced by the gas com- es largely as a means of combating Trade Unionism. Moreover, the m by which in Great Britain the State regulates the dividends that company is allowed to pay on a sliding scale depending on the selling of gas, often enables the companies to pay a profit-sharing bonus eir employees without taking the sums paid out of profits which d otherwise be distributed to the shareholders. It certainly cannot ken for granted, even in these cases, that the amount of the bonus eal *net* addition to wages; for it is at least plausible to suggest that ch an industry as the gas service, where conditions are fairly stand- ed, the bonus has come in course of time to be reckoned in effect as part of the wage, and has accordingly reacted on the level of wage-rates

In industry generally profit-sharing has certain obvious disadvantages Even apart from general fluctuations of business prosperity, the amoun of profit made by a business from year to year bears no necessary relatio to the quality of the work done by its employees. A bad sales department or inefficient buying, or faulty factory management, may far more tha counteract all the efforts of the workers ; and, on the other hand, goo management may yield profits that are not the result of the employee' efforts. Profit-sharing consequently means highly unequal rewards fo equal efforts. It tends to cut right across the lines of ordinary Trad Union bargaining, with its attempt to establish standard rates and conditions corresponding to the skill and effort required. And if, in order t meet this point, the profit-sharing firm begins by guaranteeing the Trad Union rate as a minimum to every worker, this is apt to mean that th sum available for distribution as a share in the profits is too small t make much appeal. Actually the effect of most of the schemes in operatio in the past has not been to distribute more than an average of about fiv or six per cent on the wage bill—far too small an amount to give th ordinary worker a sense of having an effective stake in the business. few firms here and there, under exceptionally favourable condition have pushed profit-sharing a good deal further than this ; but in gener its effects on the relations of employers and employed have been insi nificant.

At this point it is necessary to draw a distinction between profi sharing pure and simple and co-partnership ; for the latter implies th the workmen are given a share, not only in the profits, but also in th management of the business. This may be done in a variety of ways by allowing them to appoint one or more workmen-directors to th Board, or by issuing to them shares or stock carrying voting righ instead of a cash share in the profits, or by creating a special class workmen's shares and either giving them to the employees or sellin them at a special price.

None of these methods has so far had any appreciable effect. Th workman-director, chosen usually from among the older employees, h neither contributed much to the Board nor carried much weight wi his fellow-workers. The shares issued to the workers have seldom never been numerous enough to confer any real control ; and their iss has sometimes been hedged round with conditions that have depriv them of much of their value. There may be a case for co-partnersh here and there ; but it neither has made, nor seems likely to make, a major contribution towards solving the problems of industry. It woul moreover, if the workmen's shares did come to be a considerable pa of the total capital in the business, be open to the objection already me tioned—that the wise workman will wish to invest his savings so as spread his risks, and therefore in almost anything rather than in t business from which he draws his wages. It may be added that t system is clearly inappropriate to industries in which there is mu changing of jobs. It implies continuity of employment ; but this, in ma of the industries of to-day, does not exist for the main body of worke

I therefore dismiss both profit-sharing and co-partnership on t

ınd that, while they may serve a useful purpose here and there, they
ıot in the least likely to spread over the greater part of the industrial
. It remains to consider the proposed alternative method of improving
ions between employers and employed by the extension of “ welfare
ε ” and similar measures designed to make labour more contented
“ loyal to the firm.”

elfare work has several aspects. It includes the provision of canteens,
ing-fields, rest-rooms, libraries and other amenities at or in connexion
the works, the application of Industrial Psychology to secure better
tional selection for different jobs, and to make the conditions of
loyment more hygienic and less unpleasant, special care for the
lition of young persons and women employed, and a host of similar
sures. It may be conducted mainly by the employer acting as a
volent autocrat, or largely through organisations, such as clubs and
ties, controlled by the workers themselves, with the employer's
rvision and financial help. Like profit-sharing, it has sometimes
developed with the definite object of defeating Trade Union efforts
rganise the workers ; but in other cases it has been extensively
tised by firms whose workers are Trade Unionists, and managed
out Trade Union opposition or even with active Trade Union help.
ıe reason why Trade Unions often look askance at developments
is sort, which appear at first sight clearly desirable, is that the Trade
ın depends for its power on maintaining solidarity among all the
ers in a trade or industry, whoever their employer may be. Any-
; that tends to bind a section of the workers to a particular employer,
enlist their loyalty to a single firm, may tend to weaken their soli-
y with their fellow-workers, and to make combined action difficult
example, in a strike. And the Unions are apt to maintain that what
oyers give away in “ welfare,” they often more than recover in other
, by weakening the power of the Unions to secure improved wages
conditions. It is not suggested that this applies to all employers,
all forms of welfare work. But the practice of welfare work by
oyers hostile to Trade Unionism has given it a bad name in Trade
n circles.

“JOINT CONTROL” AND THE “RIGHT TO STRIKE”

any case, it is plain that methods of this sort, while they may to
extent improve the conditions of labour, make no radical alteration
relationship of employers and employed. They bring us back to
oint that any sort of “ joint control ” of industry is really impossible.
must be in a business some one final authority—someone who has
st word ; and this final authority, which really is control, cannot
vided between two groups that may differ on practical issues of
. It is the essence of capitalism that however much may be allowed
ade Union bargaining or Works Councils, or however much may
ne in the way of profit-sharing or welfare work, the final decision
tters of policy remains with those who represent the owners of
l, and the workmen's right is, in the last resort, still only a right to
t. This is inevitable as long as capitalism endures ; for the capitalist

cannot carry on industry at all unless he keeps the control of policy in his hands.

The workmen have no doubt the right to strike ; and this may be, on occasions, a most powerful weapon. But it is vitally different from the right to control. The workmen can give no positive orders : they can only refuse to obey and go on strike for as long as their resources allow. It is the employer who gives the orders, even if he is influenced by what the Trade Unions say. The strike and the lock-out are not really on all fours. If the employer gives an order which the workmen will not accept they have to strike ; but they have no power to give an order themselves. Ordinarily the employer has no need to resort to the lock-out. He gives his order ; and the workmen must obey, or strike.

It is an essential part of the Socialist case that this power, in the days of modern large-scale business, is too great to be left in the hands of any private person or group. The modern business is in itself a combination, with power over the lives of a large body of employees ; and the employers' association covering a whole trade or industry decides policies which react at once on hundreds of thousands of working-class households. This power, says the Socialist, is too great to be irresponsibly exercised. It cannot rightly be left in the hands of any authority less than the whole community.

In some modern States—in Australia, for example, and to a great extent in post-War Germany—this claim has been met by the institution of compulsory arbitration under the direct authority of the State. Other countries, including Great Britain, used compulsory arbitration temporarily during the War, but set it aside on the return of peace. But even now in Great Britain the State, without using absolute compulsion intervenes to help settle the wages of railway workers, and similar machinery has now been set up in the case of the coal mines. Compulsory arbitration, or something very much like it, as a method of preventing and settling industrial disputes, seems likely to spread.

Apart from compulsory arbitration, most modern States intervene in the settlement of wages and conditions in another way. They set up either generally or for particular trades, machinery for fixing and enforcing a minimum wage and a maximum working day. Great Britain has he Trade Boards to regulate wages in the sweated and underpaid trades and Germany, France, Australia and many other countries have simila machinery of varying scope. In these cases, the object is not to preven disputes or to fix an actual wage—though these are often among th actual results—but to prescribe minimum conditions, leaving the worker free to demand, or the employers free to pay, more than the minimum if they will. In the matter of working hours, again most States hav legislation limiting the duration of labour, and the first act of the International Labour Organisation of the League of Nations, on its establishment in 1919, was to draw up an International Convention for a maximum working week of forty-eight hours. There have been regrettable an indefensible delays in ratifying this Convention in many countries including Great Britain ; but it is generally recognised as the State business to prevent by law the undue prolongation of the working day

Compulsory arbitration, minimum wage enactments, and simila

asures may seem to meet the case for removing the control of the
:kers' lives and conditions from the irresponsible control of private
italism. But in fact, even when they have been adopted, these methods
:k only within narrow limits imposed by the actual operation of the
italist system. The employer cannot be compelled to keep his works
n, or to pay more than he is prepared to pay rather than close them
vn. Compulsory arbitration often works out at little more than an
mation of the relative bargaining strength of the parties, and the
ng of wages roughly at the level which they would have reached as the
ılt of a strike. Indeed, it may yield less than this ; for the arbitrators
generally drawn from a class likely to be more appreciative of the
ɔloyers' than of the workers' point of view. Only in Australia does
npulsory arbitration seem to have been an important factor in actually
ing wages ; and the results there are due mainly to the great political
ver of the Trade Union movement.

Ioreover, while compulsory arbitration and similar methods may take
actual fixing of wage-rates partly out of the employers' hands, the
e-contract actually involves many things in addition to the rate of
es. The whole pace and organisation of work in the factory gives rise
ountless problems which can in most cases be settled only in the
ory itself ; and these remain for the most part firmly in the employer's
rol, subject only to the workman's right to strike. An outside decision
he question of wage-rates and working hours limits, but by no means
ishes, the employer's autocracy. It leaves him still with the right to
orders that profoundly affect the welfare and happiness of those
m he employs.

ut this, it may be said, must remain true under any economic system.
management, however it may be appointed and whomever it may
esent, must have the right to issue orders for the conduct of work.
enough ; but again the question is : Whom ought the management
present ? It is at present an interested party, representing the share-
ers, even if it is in fact becoming more and more independent of their
It has the capitalist, and not the workers', or the community's, point
ew. Ought it not to be responsible either to those whose welfare is
directly affected by it—the workers—or to the community as a
e ?

his question has been faced already, to some extent, earlier in this
le. The Socialist policy, we have seen, is to replace the representatives
pital by representatives of the community in the final direction of
strial policy, and at the same time to delegate to the workers employed
ger, and increasing, but still subordinate, control over actual work-
administration. Socialism would not emancipate the worker from
need for obeying orders—for discipline is a necessity of industry
r any conditions—but it would cause those orders to be actually
d to an increasing extent by representatives of the workers them-
s, under the authority of a higher direction of industry representing
ommunity as a whole. This, the Socialists maintain, would alter the
psychological basis of industrialism, by making the worker feel that
rders came, not from a hostile and external power, but from an
rity he would recognise as his own and that of his fellows.

We touch here on the matter which, at bottom, most sharply divides the adherents of the two rival economic systems, Socialism and Capitalism. This is the question of the incentive to labour. The adherents of Capitalism for the most part base their argument on the natural laziness of man, and his unwillingness to labour save under the spur of necessity and the offer of a strong material incentive. Capitalism, they say, is the best system because it provides the strongest incentives—those o material gain, and because it involves, for the mass of men, the obligation to work hard and regularly in order to get the means of life. Socialism they say, would break down for two reasons : because it would not offe the man of exceptional business ability the prospect of fortune, and because it would refuse to hold over the mass of men the threat o privation as the alternative to hard work.

This argument is really made up of two elements which are, in th main, separable and distinct. The first element applies to the ordinary "rank-and-file" worker in industry, and the second to the exceptiona man or woman to whose skill, enterprise, or inventive ability industria progress is largely due. It is suggested that the inventor will not invent or the capable business organiser put forth his best endeavours unless h is given the stimulus of a strong material incentive. And it is also urged that the ordinary "rank-and-file" worker will go slow and do as little a he can, unless he, too, in his humbler way, is pushed on by materia incentives and threatened with personal and family privation if he fail to give of his best.

Most Socialists dissent strongly from both these opinions, which the believe to rest on a radical misunderstanding of human nature. The believe that the best work in business and in invention, as in the arts an sciences, is done not chiefly under the stimulus of material gain, bu because men who are conscious of possessing an ability to do exceptiona work *want* to do that work, and will be unhappy and thwarted if the are not able to do it. Such men must be given, no doubt, security an a reasonable income if they are to do their best for the community but, given these conditions, they will work, and work hard, withou any further material incentive. There are doubtless exceptions to th generalisation ; but its broad truth receives ample confirmation from th facts of present-day Society. We have only to look around us to see host of salaried managers, professional men, and administrators of a sorts working well and hard without any material incentive of the so which the critics of Socialism believe to furnish the sole stimulus successful economic effort. What these critics forget is that there are fe pleasures in life equal to that of successfully holding down a difficult an responsible job.

In its applications to the activities of the ordinary rank-and-file work it must be admitted that the argument has rather more force, for there a a great many necessary jobs within the economic system which no o feels, or is likely to feel, any urge to do—much less to carry on day in an day out, for the better part of a lifetime—for the sake of any pleasu to be derived directly from the doing of them. Few people *want* to ıen, or to descend the mine day after day, or to stand hour after hour ng an automatic machine. Most people would rather, at least for f their time, go away and play tennis, or tend their back-gardens, t pub. or club, theatre or cinema, or even stand on a soap-box and nce the capitalist system, or preach their own particular brand of us or social or ethical doctrine, or even just loaf. This is not to say ıey would sooner do nothing all their lives—only that they would not spend eight, or even six, hours a day, year after year, under creasingly exacting discipline of the economic system. Nor could acticable form of Socialism altogether change this ; for, under any ı, the world's work will have to be done, and a great deal of it will ue to be irksome in its regularity and even physically unpleasant doing.

vould therefore be Utopian, at the present stage of social develop- to expect the main body of the community to carry on all the 's work purely in a spirit of voluntary service, and without any form ect or indirect compulsion. For a long time yet the right to an ate income will have to depend on the performance of a recognised of service, and men will have to be made to contribute regular work common stock upon which they and others depend for the means . But it does not follow that the monetary incentive to production continue to occupy the same position as in the past. Socialists that, within the general obligation to perform useful labour, it possible, if the right means are applied, to create a powerful public n in favour of doing one's best and to elicit increasingly a spirit of to reinforce and gradually replace the cruder material incentives o ordinary manual labour.

y recognise, however, that this new spirit can only be aroused lly, and that the compulsion to labour in order to procure adequate of life can be superseded only as it is aroused. But they believe e existence of the capitalist system stands fatally in the way of the ing of this spirit, because, by making men's labour the means to ivate profit of the owners of industry, instead of the common , it destroys that sense of responsibility to the community which erable economic system ought above all to foster and develop.

alists look, then, to a gradual change in the human motives on dependence is to be placed for the successful working of the rial system. They believe that, if industry can be organised and lled in the common interest, a new set of motives will be brought ely into play, and good work in industry come to be recognised as a obligation fully as binding as the existing codes and conventions nt conduct which are the marks of human civilisation. They refuse ve that, for all time, man must be driven to work purely by material ves, or that a system which relies upon such incentives can possibly t or defensible for an educated people.

ıe same time, it is evident that this change in the spiritual basis of onomic order is bound to bring with it large changes in the er of the labour process. Men who readily recognise the social ons to do a good day's work will also insist that the work they are ıpon to do shall be as little irksome or deadening as the resources of science and invention can make it. A Socialist working class will insis that everything possible shall be done to eliminate “ dirty ” or unpleasan work, or at least to cut it down to the minimum. It will be alert to use ever opportunity of making machines that will effectively lighten the task o labour, because it will be no longer afraid that the machine will take awa men's jobs and throw them, unwanted, on the industrial scrap-heap Machinery, under these changed conditions, will become man's servan where it is now his master ; and men will choose, freely and democratic ally, between the alternatives of increasing their material wealth an enjoying a larger leisure by the reduction of the working-day.

Doubtless, if Society were to attempt to change over too rapidly fro the one set of motives to the other, or to dispense all at once with th compulsion to labour, there might be a great outburst of human lazines But this would speedily bring its own corrective ; for under a Sociali system men would quickly realise that they cannot eat their cake withou making it, and that the standard of life depends on the amount an skilfulness of the energy applied to production.

The Socialist has, indeed, something further to say to those who argu that a Socialist system would fail to elicit a sufficient volume of enterpris and productive energy to carry on the work of the world. He believes tha under present conditions of unequal opportunity and education, and class-barriers which it is difficult, though not impossible, to transcend, large part of the best productive ability in the world runs needlessly waste. The field for the selection of those who are to occupy the directi positions in industry, or to receive the higher kinds of professional an technical training, is not nearly wide enough to secure that the best me get the jobs they are best able to do. Greater social, economic and educa tional equality would, he believes, both result in the discovery of a muc larger supply of the higher kinds of ability and, by raising the gener quality of the population, greatly increase its productive capacity. Th better the quality of a people, both physically and mentally, the more will be able to produce and the less effort it will need to expend upon th satisfaction of the minimum requirements of living. There is room he for a great liberation of human energy which might speedily revolutioni alike the arts and sciences and the productivity of the economic syste

The Socialist, in short, to whatever school of thought he belong bases his opinions upon a fundamental belief in the powers of comm humanity. He stands for a planned and ordered development of all t resources, both human and material, that are at the disposal of Societ He does not believe that it is desirable to leave the working out economic forces to an “ unseen hand ” that is supposed somehow, wit out the application of human will or directive reason, to harmonise a co-ordinate the divided forces of individual or group enterprise a material self-seeking. He is essentially an economic rationalist, who hol that the proper utilisation of the available powers of production shou be a matter of organised collective effort, based on the fullest possib information and leading up to a systematic planning of the entire econom activity of the community as a whole.

t the present moment Russia, under the control of the followers of in, is the one country in the world where an attempt is being made to this idea of collective planning comprehensively into practice. There among Socialists many divergent views about Communism in general its particular application to Russian conditions ; but a great many ple who are not Communists, or even Socialists, are watching the sian adventure with a keen sense that its success or failure will be gnant with huge consequences for the world as a whole. The question concerns us here is not whether Communism is good or bad as a tical creed, but whether this heroic attempt of Stalin and his associates nobilise the entire productive force of the Union of Socialist Soviet ublics under a centralised economic control is, or is not, on the right s. Russia is now working under a " Five Years' Plan," in the coming of which all the economic organs of the Soviet Union were drawn close collaboration. The object of this plan is to raise immensely in a few years the Russian standard of living by bringing about an eard-of increase in the volume of both industrial and agricultural luction.

n industry especially, the Russian Government is concentrating ost superhuman efforts ; for obviously the expansion of agricultural luction depends, in the last resort, on a huge development of industry, ch must provide far more manufactured goods to exchange for the lstuffs and raw materials which the peasant produces. Russia, largely off from the outside world by lack of credits, and by the impossibility arketing abroad a greatly increased agricultural surplus, has set out to te a new balance between agriculture and industry, and at the same greatly to increase the output of both within a few crowded years of rish economic activity. Inevitably, this policy means, for the time g, a check to the rise in the Russian standard of life ; for much of the gy of the Russian workers is being devoted to the increased produc- of capital goods, or of raw products which can be exchanged for tal goods imported from abroad. But this keeping down of the standard fe is only a means to its more rapid advancement as soon as the pre- tory period is at an end ; for, the new balance once established, the sians hope to be able to use their greatly increased productive capa- to the full in making and distributing a much larger volume of con- able commodities in their own home market.

his " Five Years' Plan " is being pursued in a spirit of intense con- on, and with the aid of the most intensive propaganda that has ever applied to the whole body of a people. The workers and peasants ussia are being called upon not only to make immediate sacrifices in interests of future prosperity, but also to work with an energy hither- nparalleled for the victory of the Revolution and the cause of Socialism he economic field. Amid all the conflicting reports brought back by ors from Russia, it seems plain, at any rate, that this propaganda is ng a tremendous effect, in town and country alike, and that the Rus- people has mobilised its energies for production as no other people in ory has ever mobilised except for war. The " Five Years' Plan " may

succeed, or it may fail. Meanwhile, all Europe is watching, conscious th
its own economic destiny may depend upon the outcome.

The Russians have to face many disadvantages. They are terribly sho
of skilled workers and technicians and industrial administrators. Th
have become masters of an economic organisation devastated by war, ci
war, and international blockade, and in many of its parts deteriorat
almost beyond belief. They have to deal with a peasant agriculture, e
ceedingly backward in its methods, and with a population largely unus
to the regularity of modern factory discipline. But they have two gr
compensating advantages : a supreme belief in themselves and in th
mission, and a power that runs practically unchallenged over the ent
industrial field.

Both these factors are of vital importance. The world's great even
have been, again and again, the work of men who believed passionat
in themselves and in their mission. Communism, diverted from t
fomenting of world-revolution to the ordering of Russia's intern
affairs, is spending its passion on a colossal attempt to establish with
its own borders a Socialist economic system that shall surpass the i
dustrialisation of the great Western Powers, and pour out the fruits
Socialist productivity into the lap of the common people. It brings to t
task an enthusiasm beside which the temperate beliefs of the orthod
Socialist Parties of Western Europe seem tame indeed.

Nor is the other advantage of less account. The Socialist of Weste
Europe, attempting to work through the established institutions of p
liamentary democracy, finds himself faced with Capitalism as a goi
concern which he can but attempt to alter piecemeal, introducing a tou
of Socialism here and there in a dominantly Capitalist environment.
can make no " Five Years' Plan " at all comparable with that of the Ru
sians, because the agents through which such a Plan must be work
are, for the most part, not under his control. Mr. Ramsay MacDonal
Government cannot, like Stalin's, issue orders which become immediat
operative over the whole economic field. Some people may regard this
Stalin's disadvantage, because it confronts him with a task too great
human power. But Stalin, at any rate, does not think so. He is setting
to order, at once, the whole economy of the Russian people.

There can be no doubt that almost all Socialists envisage Socialism
involving a comprehensive Plan of the Russian type, though they m
hope that such a Plan can, in the long run, be brought into being
democratic means and without the aid of either revolution or dictat
ship. It is not within the scope of my subject to discuss this issue
method, but only the fact that any Socialist system does involve,
some stage, this process of planning systematically the entire econo
activity of the community. Socialists, when they bring forward proje
of socialisation, are thinking primarily in terms of bringing the " ke
activities of the economic system under collective control, and so of g
dually gathering into the hands of the community the powers essentia
the making and execution of a comprehensive plan.

That is why there has been, of late years, so much insistence on
collective control of the banking system, and of the entire finan
mechanism of the modern community. For men—including many

ot Socialists—have come more and more to recognise that banking ove all the "key" industry of the economic system, and that no ive control over the working of the economic order can be estab-l unless there is a firm direction of banking and financial policy. is true, not only because the Central Banks which exist in all modern trial countries are the final controllers of the volume of currency redit—as far as these things are subject to control—and, thereby, a dominant influence over the movements of prices and the ebb and of industrial activity, but also because the ordinary commercial are able, by giving or refusing credit to particular businesses, largely de the fortunes of particular industries, and to dictate the policy of which get into any sort of business difficulty. I am not asserting ne banks actually make anything like full use of their powers in these cts. In fact, they do not. But none the less the power is there, and e used; and it is clear that any State that desires to control industrial y will find in the banking system a convenient and indispensable ment of the policy.

most modern business is conducted largely on a basis of bank ; and, if this is not forthcoming in the amounts demanded, busi-nen have no alternative to contracting the scale of their operations. riction in the total volume of credit means either a diminution of pro-on, or a fall in prices, or more often both; and a restriction applied particular firm or industry means an immediate shrinkage of its nd for labour. It is not suggested that the banks are simply free to facture prosperity or adversity at will; for the Central Banks, in ding or contracting the supply of currency and credit, are governed e available supply of gold and by their estimate of the currents of monetary demand, while the commercial banks, working within nditions imposed on them by the Central Banks, can control only location of credits between different claimants, and not the total nt available for allocation. The banks are by no means wholly free ; they are bound down to the gold standard, and even if this were away with they would have still to pay regard to the international tions of indebtedness and mutual exchange. No trading country effect contract out of the world monetary system.

vertheless, the power of the banks is very great. An unduly restric-olicy on the part of a Central Bank can at any time cause widespread ployment, or an unduly inflationary policy can create the condi-for a crisis. And the commercial banks can stimulate one industry amp down another, or can use their power to enforce reorganisa-n businesses and industries which, in times of difficulty, have come heavily in their debt.

INDUSTRY AND FINANCE

ce 1918, the world has passed through successive periods of gross on of currency and credit, of currency stabilisation accompanied y by a painful economic crisis, and of monetary deflation due in a shortage and maldistribution of gold. Everything has conspired ke the solution of the currency problem seem to be the key to the gates of world prosperity ; and it is not surprising that, now as after Napoleonic Wars a century ago, the air has been thick with the procla tions of currency reformers offering simple panaceas for the ills of world. Most of these reformers have concentrated their attention—q rightly—on the absurdly paradoxical situation of modern industry, wh finds itself unable to make anything like full use of the productive po at its disposal because of a failure of demand. We have thus the ridicul situation of a world in which dire poverty co-exists with an abundanc productive resources, and even with a positive " over-production " consumable goods.

What can be more natural than to impute the blame for this to banking system, and to urge that a cure can be found in the more lib emission of purchasing power ? One school of reformers demands industrialists shall be given more abundant supplies of credit, and enabled both to produce more goods, and to distribute more mone wages, profits and other payments. Another urges that the need is no much for larger credits to the industrialists, as for more purchasing po in the hands of the general public, and therefore advocates the creat in one form or another, of " consumers' credits " designed to incr demand. Yet another urges inflation, and a rise in the price level brou about through the banking system, as a means of lowering real wa increasing the margin of profits and so inducing higher producti while a fourth school wants to increase wages, but not profits, in orde concentrate the increased demand upon consumable goods instead causing it to flow towards capital goods by way of increased saving business investment.

There is obviously no space here to examine any of these theories, n of which are a blend of truth and falsehood. What is common to them is a sense that industrial organisation cannot be worked out in indepe ence of monetary policy, and that any attempt to control industry, o master unemployment, must begin with the effective control of banking system. The Russian Five Years' Plan would have been utt unworkable if the Soviet Government had not been in complete con of the banking and financial organisation of the country.

Public control of banks and banking policy forms, then, an essen and primary ingredient in modern Socialist economic policy. And wit goes control of the investment of capital. For clearly any centrali planning of economic development involves a collective decision ab the amounts of new capital to be devoted to each enterprise include the general plan. We have here yet another point at which the Soci conception challenges the capitalist order.

At present, new capital for industry, as well as for other purpose provided mainly in two ways : by individual saving and investment by corporate accumulation of reserved profits. The sums saved in latter way remain at the disposal of the businesses which have accu lated them, and are used either to develop these businesses or for r vestment elsewhere. As we have seen, in prosperous times establis British industries very largely finance themselves by this method of porate accumulation. The sums so reserved from profits never form of the income of individuals (though their value is added to that o

l belonging to the individual shareholder). They pass directly into
ccumulation of new capital assets, without ever becoming private
e.

us, in prosperous times, British industry makes relatively few
s on the capital market in the narrower sense. This market handles
sources which individuals save out of their current incomes for in-
ent, as well as the balances available in the hands of corporate
s after they have made provision for their own needs. In the past,
large proportion of the total national saving, in the narrower sense,
en invested abroad ; and the London capital market is still far more
enced and efficient in raising capital for foreign ventures than for
velopment of British industry. This did not greatly matter as long
ish industry was able to finance itself for the most part out of re-
profits ; but of late it has mattered, especially to those industries
have suffered exceptionally from depression. For in these cases
have fallen too low to provide adequate reserves ; and the raising
v capital in the ordinary capital market has been difficult or even
sible. That is why the Bank of England has had to undertake
y the financing of such bodies as the Lancashire Cotton Corpora-
nd why the Bank of England and the Joint Stock Banks have re-
joined in creating a new body—the Bankers' Industrial Develop-
Company, specifically for the purpose of providing capital and
in connexion with approved schemes of industrial reorganisation.
m any national standpoint, the present methods of raising new
seem to be highly illogical and inconvenient. Every year, large
are distributed to individuals as income on an implied condition
eir recipients will not spend them, but will invest them in order
vide new capital for economic development. On the face of the
, it would surely be more logical to distribute as income to the
unity only what the community, taken as a whole, can afford to
and to reserve, before incomes are distributed, a sufficient sum to
e for all necessary accumulation of capital. This, it appears, is
cally what the Russians are doing under their Five Years' Plan ;
is obviously only a further development of the tendency, strongly
d already in capitalist industry, to keep back out of the profits of
ar's work enough to provide for the necessary expansion of capital.
ther words, there are clear signs that the time-honoured method
ividual saving out of income—the " abstinence " dear to the
nists of a century ago—is obsolescent as the chief means of pro-
new capital for the expansion of industry. Corporate accumula-
already taking its place to a large extent ; and it is but a step from
ate accumulation by big joint stock companies to collective accumu-
rganised and controlled by the State.

is came about, the State would clearly be in a position to deter-
ot only the necessary amount of the national saving, but also its
on among different claims—so much to this industry or service,
much to that. And, even short of a general substitution of collec-
private accumulation, much might be done—and something has
one already—to bring the utilisation of private savings more
the control of the State. This has been done by placing the

guarantee of the State behind certain investments, so as to attract into the
money that could not otherwise have been secured on such favourab
terms. Well-known instances are the issues of the London Undergrou
Railways and, more recently, of the Central Electricity Board. And it h
been strongly urged that the State ought to intervene far more activ
in the distribution of new capital by creating a National Investme
Board, empowered to borrow money from the public for the purpose
reinvestment in enterprises deemed to be of national importance
essential to the right development and restoration of industry.

The idea behind this proposal is obviously at one with the concepti
of a unified national economic plan. For, the Socialist urges, there is
reason to suppose that *laissez-faire* in the investment of capital will wo
out any better than *laissez-faire* in other spheres. The classical economi
used to assume that, if each man were left free to invest his money wh
he thought fit, his pursuit of the highest return would result automatica
in the best possible economic distribution of the available resourc
The facts of the investment market, however, reflected in the subsequ
quotations for new issues, seem to prove that the ordinary investor i
quite extraordinary bad judge even of his own prospects of profit. T
is, doubtless, largely the result of the sharp divorce between owners
and control, which means that the ordinary investor has no knowle
of the real working of the enterprises into which he puts his money,
judges of them solely on the strength of plausible "offers for sal
newspaper "tips," and day-to-day Stock Exchange prices.

Nor is it even clear that, if the investor were in a position to pick out
himself the most profitable securities, his selection would bring abou
distribution of new capital in accordance with the public interest.
would not pay the private investor to put money into reorganising, s
the coal trade, or steel, or cotton, unless a sufficient number of ot
investors were to do the same; whereas the State, by mobilising
capital resources needed to make reorganisation effective, might be a
to convert an unprofitable into a profitable venture. Already, a substan
amount of new capital is invested—in housing, for example—under
direct influence of the State. It seems likely that the proportion of inv
ment so influenced will, and should, be greatly increased in the n
future; and it is clear that the collective direction of the national inv
ment forms an integral part of any Socialist system.

THE CO-OPERATIVE MOVEMENT

Socialist projects have to reckon, however, not only with the r
dominant system of capitalism, but also with other rivals to capital
which have grown up within the existing order. By far the most powe
of these rivals is the consumers' Co-operative Movement, which
already brought under its control a large share of the total retail trad
consumable goods, and produces in its own factories a considerable
portion of the goods which are sold in its shops. In 1929 the distribu
Co-operative Societies in Great Britain had over six million members,
the Co-operative Movement on a whole employed a quarter of a mil
workers, and had a wages bill of £32,000,000, and a capital of ab

,000,000. Its retail trade alone amounted to £217,000,000, and its esale trade to over £117,000,000, while the productions of the esale societies only were valued at £38,000,000.

w, the consumers' Co-operative Movement is, in its form, neither alist nor Socialist. It pays, indeed, a fixed rate of interest on its and loan capital; but it distributes its surplus, not to shareholders, o members as a rebate on their purchases. It has thus retained est, but eliminated profits in the capitalist sense. It is, however, a tary movement, wholly independent of the State.

me co-operators look forward to a time when all trade and production e carried on co-operatively, and regard Co-operation as a complete ative to both capitalism and Socialism. But this is certainly not ew of the majority; nor is it at all likely to come about. Co-operation nirably suited to the distribution and production of many kinds of mers' goods, especially those which enter into the regular weekly et of the ordinary housewife; but it is most unlikely to become the s of organising the great staple industries, such as coal, steel and eering, or the supply of the great public services, such as transport, vater, electricity and housing.

practice, Socialists and Co-operators, allied in their political and mic aims, usually get along well enough together. No important l of Socialists wants the State, or any other public authority, to over the Co-operative Movement, or the main groups of services which it deals. On the contrary, Socialists desire to extend the and power of consumers' Co-operation, and to strengthen it by ssurance of State help. Even in Russia, where the Soviet Govern- did at one time attempt to nationalise the Co-operative Movement, dependence was speedily restored, and it now acts in close con- on with the State, and is playing its full part in the formulation and tion of the Five Years' Plan. There may be marginal disputes the respective spheres of State and municipal, and of Co-operative, prise; but there is, in practice, no general hostility between the two ns.

fact, no Socialist wants to nationalise or municipalise everything. nodern Socialist alternative to capitalism is not a rigid or uniform n of economic organisation, but a diverse method of organising ent industries and services within a common plan. It may include irect nationalisation and national management of certain services as social insurance; the direct municipal ownership and manage- of others, such as water, or gas, or purely local transport; the gement of yet others, including such key industries and services as ng, long-distance transport, and coal-mining, through public service rations on the model of the Central Electricity Board and the pro- new Traffic Authority for Greater London; and the Co-operative ship and management of others such as the distribution and pro- n of staple consumable commodities. It may, moreover, be content ve some industries and services, especially those which can be d on economically on a small scale, in private hands, but subject ying degrees and forms of public control over such matters as wages and the provision of new capital for development. The

more Socialists are faced with the necessity of formulating practic
policies for early adoption, the less rigid their proposals become. Socia
ism, in its earlier propagandist stages, was under the necessity of puttin
forward simple and comprehensive ideas that could be easily and wide
understood. The practical application of these ideas inevitably destro
that primitive simplicity; for in practice each industry and servi
presents special problems of its own, and calls for somewhat differe
methods of organisation. The essence of Socialism lies, not in any pa
ticular method of administering industry, but in the insistence on t
need for bringing all industry under the ultimate control of the con
munity, and for planning comprehensively in the public interest t
entire development of the economic system.

In this Article, I have drawn my examples largely from two countrie
Great Britain and Russia, and have conducted the general argume
largely in terms of British conditions. I have done this because I kno
the British conditions best, and because Russia is the one country
which a comprehensive attempt is being made to work out a Social
system in practice. I think, however, that what I have said of the develo
ment of Socialism, and of the conflict of industrial theories, in Gre
Britain applies largely in the same way to other developed Europe
countries as well. It would have been easy, for example, to take paral
examples in most cases from the post-War developments of Germ
industry, and from the evolution of German economic thought. Walth
Rathenau in Germany has made the most significant contribution to t
theory of organised, State-controlled Capitalism, passing by gradatio
to the idea of public service on the basis of a systematised economic ord
Germany, even more than Great Britain, has been fertile in experimen
in "semi-public" enterprise, on the lines I have illustrated by t
example of the British Central Electricity Board. In France, less h
been done in practice, because the Labour Movement there is l
strong and the industrial system as a whole at a less advanced stage; b
the French Trade Unions formulated, on the morrow of the War,
plan of "industrialised nationalisation" which has much in comm
with the recent tendencies in thought and practice in Great Britain.

EUROPE AND AMERICA

In the United States of America, on the other hand, the tendenc
that I have described, while they exist and are becoming more active,
the example of the United States Federal Farm Board clearly shows,
not yet appear so plainly on the surface, because there Socialism is s
only the creed of a tiny minority, and the practical need has not
arisen, or has not yet been recognised, for any wide extension of t
powers of the State over industry. Co-operation, too, is there still in
infancy, and Trade Unionism weak, save in a few closely organis
industries. America, as we have seen earlier in this Article, is still thinki
in terms of a quasi-democratic capitalism, able to satisfy working-cl
aspirations by the offer of a rising standard of life and an easier moveme
from class to class than is possible in older countries. Nor is this Americ
ideal likely to be seriously challenged on American soil as long as

inues successfully to offer these advantages. If at any time it fails to them, a very different situation is bound to arise ; for the American le, used to rapidly rising wealth, is likely to be more intolerant than other of any serious check to its material progress. Whether it will, er such conditions, " go Socialist," more or less on the familiar pean lines, or create for itself a new American gospel of its own, knows ? Certainly, I do not propose to venture into prophecy on a matter, for the conditions are not even now ripe ; I can only ster the doubt whether American capitalism is as stable as it has erto seemed, and suggest that the American public would be wise to y the development of European economic thought and action no intently than European opinion is intent on watching the great ted States experiment in standardised mass production on a basis of ate ownership and control. Europe has something to learn from erica ; but has America nothing still to learn from Europe, and par- larly from the latest trends of European economic organisation and cy ? In Europe, at any rate, the current is well set in the direction of ective economic control and of experiments in semi-Socialist organi- on. At present, the rate of advance is not rapid ; for even capitalism ifficulties is very powerful in defence, and Socialism, without any r majority of opinion behind it, can but attack a few outposts of the ting order. The economic future of Europe, I think, depends very ely on the success or failure of the Russian experiment ; and on that rvers in other countries can but wait with bated breath. For, whether munism be right or wrong, the Russian attempt to establish a plete Socialist system is certainly the outstanding economic experi- t of our time.

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THEORIES AND FORMS OF POLITICAL ORGANISATION

By

G. D. H. COLE

SYNOPSIS

subject-matter of Politics — Political Science and Political Philo-
y — The forms of social organisation and the ultimate basis of
an societies — The close connection between the two groups
roblems — All political theories are theories about the nature of
— This is the basis of Plato's *Republic* — The doctrine of
tion as the basis of political rights and duties — The Greek
-State — Aristotle as its interpreter and as the founder of
tical science — Greek democracy — The political ideas of the
ans — The legacy of Roman Law — Political theories in the
dle Ages — Church and State — The idea of universality —
dation and privilege — Towns and Guilds — Politics as a branch
orals — The Reformation — The politics of Machiavelli — Their
lar tone — The political ideas of Luther and Calvin — Calvin-
as a school of self-government — The Reformation in England
ooker's *Ecclesiastical Polity* — The Divine Right of Kings —
ideas of the Puritans — Politics under the Restoration —
bes and the Sovereign State — John Locke and the English
olution — Locke as the founder of modern political thought —
lish aristocratic ideas in the eighteenth century — Montesquieu
the separation of powers — Rousseau's *Social Contract* — The
eral Will — The ideas of the founders of the United States —
French Revolution — Burke as the philosopher of Conserva-
— Why France had a Revolution and England only a Reform
entham and the English Utilitarians — Their influence on
sh politics in the nineteenth century — The growth of *laissez-*
— Constructive Benthamism — John Stuart Mill — Conti-
al political theory in the nineteenth century — Hegelianism
he metaphysical view of the State — Marxism and the Material-
Conception of History — The Marxian criticism of parlia-
tary democracy — Europe after 1848 — The political influence
arwinism — The growth of Anthropology and Psychology —
attack on rationalist conceptions of politics — The revolt

against parliamentary institutions — Importance of volunta
association — Maitland and Gierke — Political Pluralism — bas
on the rise of combines and Trade Unions — Syndicalism an I
dustrial Unionism —Guild Socialism — Parallel religious movemen
— Georges Sorel and the General Strike — Effects of the War
politics and political theory — Revolution in Germany — and
Russia — Political ideas of the Russian Revolution — Communis
contrasted with Social Democracy — The Communist idea of t
State — The dictatorship of the proletariat — Rôle of the Com
munist Party — The Soviet system — Economic organisation of t
U.S.S.R. — Communism and Fascism compared — The rise
Fascism in Italy — Breakdown of Italian parliamentarism — and
Socialism in Italy — Mussolini and D'Annunzio — Fascism a
the " National Idea " — Its relation to Hegel — Fascism and t
" Corporative State " — Nationalism in the nineteenth and twe
tieth centuries — *L'Action Française* — Hitler in Germany — Pa
liamentarism in the balance — The position in Great Britain
The changing functions of the modern State — The fundamen
nature of modern party cleavages — Socialism *versus* Capitalis
as the main issue — The position in the United States of Ameri
— The demand for national economic planning — Does Socialis
involve dictatorship ?

THEORIES AND FORMS OF POLITICAL ORGANISATION

er since the theory of Politics has existed, men have been trying by ns of it to answer two different questions : How can Society, or this iat Society, best be organised and administered ? and How does it e about that Societies exist, or can exist, at all ? The first question is tical ; and those who are impelled to ask it are seeking answers to lems of their own day and generation—problems that must be ved somehow, for good or ill, and will not wait upon man's ability to good answers, or on the progress of human knowledge. For, in one or another, Societies do exist, and have to be administered. The nd question is, in form, theoretical and philosophic. It sets on foot an iry into the nature of man as a being capable of living in Society, and the fundamental principles of political obligation. There is no such ncy to answer it, somehow, as exists in the other case ; but throughout ges men go on asking it, and will not be content without some form of er. Shall we say that in the first case the necessity is practical and nal, whereas in the second the demand for an answer arises out of an necessity of the human mind ?

some measure this is true ; but it is, in fact, always impossible to the two questions apart. Men's theoretical curiosity about the of political association mingles in every age with their practical e to set Society in order ; and they are for ever seeking, in the true e of man and Society, justifications for the particular forms of l and political organisation which they desire to impose upon their v-men, or to persuade them voluntarily to accept. Every age seeks ipport contemporary " causes " with theories for which universal ity is claimed ; and every age makes its supposedly universal theories one eye on the movement of contemporary events. Political Philo- y may be centred round the second question, and Political Science he Art of Politics round the first. But the two constantly interpene- and combine, despite repeated efforts to keep them apart. Political sophy and Political Science have not separate histories, but one y common to them both, with shiftings of emphasis now this way iow that ; and the Art of Politics draws argument and illustration both alike.

e attempt to separate Political Philosophy and Political Science deed, comparatively modern. Foreshadowed by Rousseau in the eenth century, when he set out to distinguish the object of his own cal writings from that of Montesquieu's, it was proved impossible in reat welter of theoretical and practical question-and-answer that we he French Revolution. Revived again in the nineteenth century the powerful stimulus of scientific advance, it has achieved no better success in the world of to-day. Marxism and its derivative Communism are inextricable minglings of theoretical and practical reasoning and Gentile, the philosopher of Italian Fascism, writes of the " Nationa Idea " in terms which base the practical structure of the Fascist Stat directly on ultimate philosophic realities.

Nor is this at all surprising. The sort of mechanism men will want t create within Society will depend on what they want Society to be ; an their view of what Society should be will depend on their view of man' nature as a social being. There can be no universal " Science of Politics unless there can be a universally accepted doctrine concerning man' social nature.

That, of course, makes it terribly hard to mark off, even provisionall the field of political theory from the fields of other social studies. A political theories, and all practical judgments about politics, are bound t rest on assumptions, or dogmas, or doctrines about the nature of men their instincts, desires, teachability, strength of will, patience, suggest bility, imitativeness, and a host of other characteristics innate or acquired This psychological basis of politics may be more or less conscious or un conscious, explicit or implied, in the work of different writers and states men. But it can never be absent ; for it is a sheer impossibility to formulate a single political theory or project without making assumptions abo the nature of man.

THE GREEK CITY-STATE

This necessity received full recognition at the dawn of consciou political theory among the Greeks of the classical period. Plato's psychology is his politics, and his political theory is his psychology, readers of *The Republic* are well aware. There are, for Plato, three parts the human soul : that which knows (the philosophic) ; that which is full zeal and bravery (the spirited) ; and that which merely seeks bodily sati faction (the appetitive)—and there are three corresponding parts in tl structure of human Society, if it is rightly founded. Plato's philosophe king stands for the necessary domination of knowledge over both spi and desire in the body politic. Or, in a Republic, his guardians must ru as embodiments of the same principle, with a brave and zealous soldie under them, and a merely appetitive populace kept well in subjection do the productive work of the community. Plato's conception is esse tially aristocratic. He sweeps democratic arguments and talk abo equality of rights aside by claiming that in Society, as in a man's ov soul, the best part should rule in the interests of the whole. And sustains this dogma with his doctrine of " function." Each man, accor ing to the varying composition of his soul out of the three parts whi together make it up, has his proper function in the social system. T philosopher's function is to rule, because he knows what is best. T others can have no claim to rule, because they do not know.

Thus, at the very beginning of systematic political theory, all the gr questions that have perplexed later ages are raised at once. Is politi authority a matter of inalienable human right, belonging to a man sim because he is a man, or is it a matter of knowledge ? Should the expert er orders, or give them? Is politics a field for specialists, or for nary men and women? Does democracy involve a mere babble of herent voices, or is the voice of the people, in some sense, the voice of l? And underlying all these questions is another, more fundamental : What is man? What is his nature? We must know that, or at least to know, before we can begin to say how he ought to rule and be d.

lato, of course, was theorising, and preaching practical doctrine, narily for the Greek City-State. The Greek cities and islands were, eed, the first great nurseries of political theory and of conscious ex- ment by the people in methods of government. Above all is this true thens, which was, at the height of its power in the fifth century B.C., lly organised democratic republic of citizens, though slaves and the e foreign population which dwelt there had no part in the government. o, however, was writing amid the decay of the Athenian Empire after defeat of Athens by Sparta in the Peloponnesian War, and when the ies of Athenian democracy had been for the time extinguished. His essor, Aristotle, often acclaimed as the Father of the Science of tics as of many other sciences, strikes a different note. Plato was con- ed to build up in thought an ideal republic, to fit the real needs of the an spirit. Aristotle was content rather to take the best of the available s and methods of government, recognising that all were imperfect, seeking to distinguish between better and worse on the basis of an orate study of the comparative institutions of different States. totle, too, writes of, and for, the City-State, which he regards as the est form of civilisation, and as marking off Greeks from the "barans" who make up the rest of the world. His best State is, like o's, aristocratic in a sense, in that he will not allow that slaves, or those do manual work, have any claim to citizenship. But among the en body he advocates a fairly wide distribution of political power, ing a mixed constitution embodying both democratic and aristocratic ents.

istotle, however, counts as a political theorist not only for his des- ion of the best type of City-State, but also because of his insistence "man is by nature a social animal," so that living in Society comes to by way of nature, and not by any merely artificial contract or coer- , and so that Society itself does not really need explaining at all. a fact, arising out of man's nature, and developing from the mere ly stage up to the fully grown City-State as men advance in know- e and culture.

ato and Aristotle between them set the fashion, and laid down the e, of political theory for many generations. Aristotle's influence, e all, remained alive and pervasive all through the Roman period, the lled "Dark Ages" and the Middle Ages, and so passed on into the ern world. Plato, largely forgotten between the decline of Rome and Renaissance, came back to widespread influence at the Renaissance, s still to-day the most widely read of all the great political thinkers.

ne City-State of the Greeks exhibited, indeed, wherever it existed, an ishing fertility of political experiment and diverse governmental cture. Athens herself, like many of the other cities, was governed in turn by legitimate kings, by “ tyrants ”—that is, by personal rulers wh seized power without legitimate title—by its aristocracy, and by th entire body of its citizens, and then again by aristocracies and demc cracies in turn, with a bewildering variety of forms and methods c administration. But with all these forms of government there was som thing in common—the fact that, even in Athens, by far the most popu lous of Greek cities, the entire body of citizens was small enough to tak a direct part in the government, or at least to be consulted as a sing assembly, or to exert as a single and direct group of individuals a pressu of public opinion. Democracy, in its characteristic Athenian form, mea direct government by the people, issuing in primary assembly dire orders to their elected magistrates. A great magistrate, like Pericle might guide them by personal ascendancy and leadership ; but he had lead, not a body of representatives, but the whole people. Moreover, mo of the offices were elective, or depended on a mixed system of lot ar election ; and these offices were very numerous in relation to the size the population, and were mostly part-time occupations, so that a ve high proportion of the whole body of citizens at some time held son definite office. The Greek City-States, save to a small extent in the federal relationships one with another, did not use, and hardly knew, t device of representative government which we in the modern world ha come to regard as inseparable from democratic institutions. In classic Greece, active and not merely passive citizenship was regarded as t normal duty and privilege of every citizen ; and political consciousne was widely diffused through the entire community, which ranked po tical activity among its most constant and liveliest interests.

This did not make for tranquil government. Indeed, the Greek Cit States easily outdid the modern Republics of South America in t number of their revolutions. Nor did it always make for wisdom : t democracy of Athens, in the days of its decline, was apt to be as excitab unstable and shortsighted as the aristocracy was apt to be self-seeking a tyrannical. But it is safe to say that the Greeks, more than any oth people in the history of the world, did really govern themselves and ta the business of self-government seriously.

ANCIENT ROME

Rome, too, began as a City-State, to become the Imperial City o world empire. The Romans, like the Greeks, passed from monarchy aristocracy, and from aristocracy to a mixed constitution partaking democracy. But the Roman democracy could not govern the rapi spreading Roman Empire, which could only be held together by a stro and highly concentrated central power. After the brief episode of Triumvirates, Cæsar's successor, Augustus, made himself Emperor, a thereafter, as long as the Empire held together, Rome was governed b single ruler.

Great above all as practitioners of the art of ruling, the Romans queathed to the world their political theories in a strictly practical fo What theories they had were deeply influenced by the later Greek ph sophy of Stoicism, which left its mark on the development of Roman l cially in its international aspects. They have left to us no great books olitics like those of Plato and Aristotle ; but they have left the im- ;hably influential monument of Roman law. The legal system which impressed upon Europe, which permeated the Canon Law and the Law of the Middle Ages, which is still the foundation of much in the systems of the modern world, is the sole distinctive contribution of ical Rome to the theory of politics. It is, however, a many-sided ribution enough. The theory of State sovereignty, which still domi- ; the modern world, comes from it. So does the conception of abso- monarchy, yet of monarchy working not by caprice, but according to And, on the other hand, to it we owe, through the *Jus Gentium*, the of the conception of an International Law extending to all men and les by virtue of a common rule of human reason underlying all nal codes, and also the idea of a universal Empire which was ever nt in the mind of Mediæval Christendom, and lay behind the claims of the Holy Roman Empire and of the Papacy. Roman law, more- gave to the world the conception of corporate personality as the ion of the State, making all corporations and associations derive their gnised being from the fiat of political authority, and thus coming into ict in the modern world with Germanic conceptions of voluntary iations as no less natural and spontaneous and subsisting by their right than the general political associations which we call " States."

THE MIDDLE AGES

ediæval political theory built largely on Roman foundations, with thing of Aristotle to eke out the theoretical jejuneness of Roman ght. It took from Rome the idea of universality, and from Aristotle dea of Society as natural to man and as necessary to man for the nent of his vital purposes. But the Holy Roman Empire, with its ense complexity of feudal and corporate rights and duties, was never, ct, at all like the Empire of Augustus. It divided power among se claimants as much as the Romans had united it under a single It dreamed of universality ; but even the universal Church had actice to recognise narrow limits to its power of interfering with maller powers which held temporal sway over Christendom. The lle Ages have left, from the early Canonists and Civilians to St. nas Aquinas, much brilliant political thinking behind them ; but made no realistic political theory that fitted the complicated political social adjustments of the mediæval world. There are mediæval ies, as in Aquinas, about the common basis of all human Societies ; are theories of the " two powers " of Church and State, and ies of the universal dominion of the successors of St. Peter. And are theories, derived partly from Aristotle, about property and its ; and duties. But of feudalism as it was, or of the corporate per- ity of mediæval towns and guilds, the Middle Ages made no theory at hat was left for moderns like Gierke and Maitland and Figgis to do as rians, after the conditions which they described had long passed away. art from the Roman influence, the dominant quality of mediæval cal thinking lies in its treatment of politics as a branch of morals.

The mediæval thinker, basing his thought upon the claims of the un versal Church to regulate right conduct, treated every problem in politi and economics as a problem of theological morality. This is seen, in th economic field, in the elaborate codes prohibiting “ usury ” and definin the conditions under which profits could justly be made by a Christian and, in politics, it appears in the attempt to derive all authority in th State, and all principles of obedience in the subject, from the will of Go as manifested in Scripture and in the inspired utterances of the Cathol Church. The conscious political thought of the Middle Ages dress itself in the garments of revealed religion, and throws around doctrin derived from Aristotle and from Roman Law the sanctions of the Churc

RENAISSANCE AND REFORMATION

The Reformation was no less theological in its politics than the Midd Ages. It was, indeed, in practice a good deal more so ; for theologic controversy, touching the very foundations of the Catholic syste speedily reacted on politics, and texts out of Scripture were never flu to and fro in desperate combat more fiercely than between the politic disputants of the sixteenth and seventeenth centuries. It is true that the eve of the Reformation a purely secular note is struck once, with startling clearness that horrified a world used to thinking in theologic terms. Niccolo Machiavelli was regarded in his own day, and long afte wards, as an immoral cynic, preaching a doctrine to appeal to tyra claiming immunity from all ethical considerations. But Machiavelli w in truth, rather secularist than cynic. He was seeking for political thoug and action a realistic basis in the facts of human behaviour rather than the Scriptures or any *a priori* set of moral principles. If the result w cynicism, that was because the author of *The Prince*, strong enough break through the universal integument of contemporary thought, w not clear enough in his own mind to formulate a new body of posit principles. He saw Italy torn asunder by the constant struggles of pe tyrants and republics, by the ambitions and intrigues of the Papacy, a by the repeated interventions of strong military powers which, in internal divisions, she was impotent to resist. He wanted a strong It —Italy a nation—and saw the one hope of this in the creation of a pur secular and authoritative State, powerful enough both to repel the f eigner and to deal effectively with the disruptive tactics of ambitio Popes seeking temporal power. Making this his aim, he subordinated it all considerations of morality and fair dealing between men, and p duced a monstrosity of political thought which was none the less semi of great ideas for being in part notably immoral in its immediate teachi

Machiavelli's *Prince*, striking the note of nationalism and making limited claims for the secular power, became the secret manual of am tious monarchs who were engaged in building up strong national Sta on the ruins of the Universal Empire and the Universal Church. But in realm of political theory it is long before his secularism finds an import echo. The true successor of Machiavelli is the Englishman, Tho Hobbes, a century and a half later ; and between these two lie the formation and the great wave of religion that followed hard upon it

he Reformers, Lutheran and Calvinist alike, set out primarily to
bat the Papacy in the religious field. But the contention was bound
e at once political as well as theological. Martin Luther and his fol-
rs could not hope to fight the papal claims with success unless they
d array on their side secular support, to protect them against sup-
sion and persecution and to balance the temporal power of the Papacy
the Catholic monarchs. Thus Luther was led irresistibly to ally him-
with the rising national States, and to defend to the uttermost the
ns of sympathetic secular rulers to absolute monarchy. His fierce
inciations of the German Peasants' Revolt follow logically upon this
ice between the new-made Lutheran Church and the temporal
ns of the German Princes. Making religion, indeed, a matter of in-
lual conscience and direct interpretation of the Scriptures without
nediation of a universal and inspired Church, the Lutherans became,
litics, the defenders of absolute monarchy to an extent that speedily
iced the religious freedom from which they had set out. *Cujus regio,*
religio lurked dangerously in the background of the Lutheran
rine.

lvinism, and to a less extent Zwinglism, in their original homes in
zerland and speedily elsewhere, took another road combining,
ever they were strong enough, Church and State into a single unity
inated by a rigid and exacting moral code based on a new Puritan
pretation of scriptural precept. Calvin's revolution was, above all,
olution in morals, which sought to make of Church and State alike
uments of moral control over the lives of men. In this, Calvinism
ed on, extended, and made far more rigorous, the mediæval tradi-
Calvin was the Pope of Geneva in a far more exacting sense than
had ever been a Pope of Rome. His *Institutes* are as thoroughly
æval in tone and temper as they are unlike the Middle Ages in the
uments which they devise to sanction their moral precepts. The
e of these instruments, secondary for Calvin, nevertheless gives
inism its pre-eminent importance in the development of political
ght. For Calvin, having broken from the universal Catholic Church,
compelled both to set up a new instrument of Church government
place, and to furnish forth a State armed to defend his Church.

could do this only by building Church and State alike on the col-
e will and activity of the body of the faithful. Calvin's Geneva was
om being a democracy : it was based essentially on the domination
aristocracy of the Saints. But there were in it the seeds of democracy,
ise it appealed not to the traditional authority of a Church ruling by
and prescript, but to the continuous sustaining force of its own
bership.

ie democratic qualities inherent in this Calvinist conception made
selves far more plainly impressive wherever the Calvinists were not,
Geneva, in power, but in a minority. For where Calvinism had,
in face of persecution, to organise itself as a Church without being
to remake the State in its own image, it became of necessity a force
ng for self-government. Undoubtedly, it diffused over Europe a
rful impulse towards self-governing institutions, and was the most
ential ally of the changing economic conditions of the time in setting

the face of Europe towards the development of democratic attitudes and forms of social organisation.

It is not possible in this Article to pursue further the conjoint course o religious struggles and political speculation and action in the Europe o the sixteenth and seventeenth centuries, to discuss the political theorie of the Counter-Reformation, the doctrines and policies of French thinkers such as Bodin and the author of the *Vindiciæ contra Tyrannos*, or th Dutch and German contributions of Althusius, Grotius, Spinoza, anc many more great names to the theories of politics and of internationa law. I must be content only to say a little about the course of politica theory in England during this season of world-wide conflict of both aim and ideas.

The English Reformation was as nearly secular in its basis as it is possible for a nominally religious movement to be. The cleavage betwee Henry VIII and the Papacy raised no fundamental question either o theology or of moral conduct ; and the Church of England set out on it independent career without any break either with Catholic theology o with the Catholic moral code. There was an institutional break ; that wa almost all. But such a break involved the abandonment of the ideas of universality ; and the declaration of independence of the English Churc formally ratified and practically consolidated the complete and separat sovereignty of the English State. If at Geneva the State had becom almost a branch of the Church, in England the Church became almos a branch of the State.

Thereafter a difficult situation arose. Calvinists, standing for a mor revolution to be enforced by a union of Church and State, with th Church as the dominant partner, were not likely to be satisfied with wha had been done. But Calvinism was strong and growing ; and it seeme essential to found the new English Church on a basis broad enough t include all the King's loyal subjects ; for Church and State were though of as co-extensive. Hence the movement, best illustrated in Richar Hooker's *Ecclesiastical Polity*, for a Church broad enough and toleran enough to command the acquiescence of all good Englishmen, eve if the extremer Catholics and the extremer Calvinists alike repudiate its tolerance. Hooker's masterpiece is directed above all against th Calvinists within the gates. They are wrong, he urges, in seeking t derive from Scripture binding rules of conduct and practice to regula every occasion, secular and religious alike. It takes many sorts to make world ; and there is a wide sphere of conduct within which God has la down no universal precepts, but left men free to decide on their cour according to the expediency of time and place, always under the rule the law of nature and reason.

Hooker's tolerance, however, came before its time ; and for a centu circumstances were too strong for his solution to prevail. England the seventeenth century plunged, like the rest of Europe, into warfare which considerations of religion and politics were mingled inextricab together, with the rising commercial classes ranged under the banner Puritanism to destroy absolute monarchy in the name of a freedo of conscience which was also a freedom to break down the barriers mediævalism and create a State responsive to the needs of the ne merce, the new industry, and the new forms of capitalist farming ed on enclosure of the land.

nless the Stuart monarchs, under the spell of their fatal belief in the ine Right of Kings, had made egregious blunders, English Puritanism ld hardly have triumphed even for a time; for the mass of people ld have been well content with a compromise. But Charles I threw y his crown and his head; and England experienced, for a moment, rule of the Saints. But the Genevese model, despite its appeal to on and other leading Puritans, would not serve for England, being ed essentially a form of city rather than of national government. mwell dismissed the "Rump," and ruled for a while personally in name of the Saints. But such a personal autocracy could have no perence; for most of England was not Puritan, and it exceeded the ngth of Cromwell and his Saints to convert it. The Restoration was itable from the moment when the alliance of Presbyterians and pendents fell asunder.

ut, though Charles II came back to reign, much had been changed, the kingly power had been greatly diminished for good and all. Puritans had failed; but they left behind a trail of broken institus and beliefs. Though James II's Catholicism was the occasion of his g his crown, he and his descendants could have held it only if they been content to let England develop from absolute monarchy to ocracy. After the death of Cromwell and the decay of belief in the ne Right of Kings, the one power that was strong enough to rule the try was the landed aristocracy. The rising commercial classes were yet nearly strong enough to govern on secular grounds. The only ible secular government was that of the great Whig houses which l England from 1688 onwards.

HOBBES AND HIS INFLUENCE

itish political theory, founded by Hooker, took shape in the midst e great conflicts of the seventeenth century. Apologists of the Divine t of Kings, from James I himself to Sir Robert Filmer, did battle Puritan apologists such as Milton and Algernon Sidney, reinforced ames Harrington with his *Oceana* on the one hand and by the author *ikon Basilike* on the other. But far more significant than anything en from the standpoint of either the Divine Right of Kings or the of the Saints is the contribution of Thomas Hobbes of Malmesbury. er in the century Francis Bacon had set in his *Essays* the Machian fashion of a secular approach to the problems of State; and later, e height of the civil conflict, Hobbes elaborated, on the side of mon- but in sharp hostility to the doctrine of divine right, his famous y of sovereignty based upon an all-embracing Social Contract.

Hobbes's mind the first need of Society was order and, therefore, wer armed with absolute authority for the enforcement of order. reas Hooker, like Aristotle, had regarded Society as natural to man, herefore as needing, in the last resort, no explanation, Hobbes rented it as an artificial condition, and the natural condition of men war of all against all, from which Society, by enforcing order and justice, offered them the only way of escape. The institution of Societ was thus represented as a purely rational act, done by men for self-preservation and requiring the continuous sanction of absolute authorit to hold its artificial unity together. Justice, according to Hobbes, was n less artificial than Society itself, and existed only in Society, as the la imposed by the sovereign. And the sovereign derived his title to obedience solely from his effective power to enforce the law ; for if he coul not enforce it the social contract was dissolved, and no further mora obligation could subsist.

On an utterly false psychological foundation Hobbes thus erected theory of Society ruthlessly logical, if once his initial assumptions wer granted. And this theory of his, despite its false psychology, has exercise and still exercises, an enormous influence. Straight out of Hobbes cam the legal theories of Austin and his followers, with their insistence on th absolute, unlimited and indivisible sovereignty of the State. And out Hobbes, too, though he was by no means its originator, comes th practical application to political theory and constitution-making of th doctrine of the Social Contract.

The fall of the Divine Right of Kings had left absolutism without theoretical basis. Hobbes gave it a new secular foundation ; but th absolutism which he preached did not belong, of necessity, to a sing ruler, but to the government of Society, whatever form it might tak Hobbes preferred monarchy, as likely to be more efficient in the prese vation of order ; but he recognised that his doctrine could be applie equally well to justify the absolutism of an aristocratic or a democrat as of a monarchical government. The essence of his doctrine is that to th government, whatever its form, belongs absolute power over all the su jects.

In his own day, Hobbes found his doctrines rejected by all partie The Cavaliers would have none of him, though he claimed to be on the side ; for they wanted the King to rule by divine right. The opponents monarchy would not accept him ; for they mostly wanted to limit t King's power. The Saints rejected him ; for they wanted to base their ru on theological and not on secular grounds. Only in the next generatio when the practical conflict had taken on a new form, did Hobbes's i fluence make itself plain.

THE ENGLISH REVOLUTION

It appears very plainly in Locke, the philosopher of the English Rev lution of 1688, though Locke traverses most of Hobbes's doctrines a avows himself a follower rather of Hooker than of the author of *Leviath* Locke sets out, indeed, to limit the authority of governments and to co fine them mainly to the duty of protecting the liberty and property of t subjects. He recognises that Society is natural to man and rests his ca on a quite different psychology from that of Hobbes. And he derives t principles of politics from the laws of God and Nature and not, li Hobbes, from an act of human reason which removes Man from t sphere and state of Nature. But all the same he owes a great deal Hobbes ; and his theory of the Social Contract could never have be formulated as it was without Hobbes's theory to serve as a foundation.

For Locke distinguishes, as Hobbes did not, between Society and the
vernment. Society is, indeed, based on a contract among men and
stained by their continuous consent to its being. In Hobbes the people
up a sovereign once and for all, and in doing so transferred and alien-
ed to him and his successors all their power for evermore. The con-
ctual act was the setting up of the government. In Locke this theory
anges its content. The people do not for ever alienate their rights. They
nain always sovereign, with perpetual power to recall and abolish the
vernment they have established if it prove at any time false to its trust.
id as sovereignty remains in them, absolute and unlimited, the power
government can be limited as much as you please, short of destroying
validity altogether. Thus, Hobbes's absolutism serves as the frame-
rk for Locke's very different theory of limited and constitutional go-
rnment as the defender of property rights—a theoretical version of
practical achievement of the English Revolution of 1688.

After 1688 England settled down to aristocratic government with a
iited constitutional monarch as its titular head. For some time, in face
the practical settlement of affairs, political speculation went to sleep,
ceased to concern itself with fundamentals. The early eighteenth
ntury formulated, in the writings of Hoadly and others, highly Erastian
eories of the relation between Church and State ; it advanced slowly
vards the acceptance of some of Locke's ideas about religious tolera-
n ; it produced many admirable political pamphlets, written by such
sters of English prose as Swift and Steele, Addison and Defoe ; and
gave a fine exhibition of charlatanism and virtuosity in Bolingbroke's
triot King. But on the whole its tone and temper is best expressed in
pe's *Essay on Man*, with its twin assertions that " whatever is is right,"
d that :

For forms of government let fools contest :
Whate'er is best administered is best.

ot that the early eighteenth century was really indifferent about the
ms of government, but that it regarded political authority as too
urely settled in the hands of the aristocracy for its nature to be worth
ch argument.

Political speculation, which had found its home in England in the
enteenth century, thereupon crossed the Channel to France. Locke's
tings were of immense influence upon the Continent ; and Mon-
quieu, who reintroduced Aristotle's method by basing his speculations
a comparison and analysis of actual constitutions past and present,
her than on *a priori* principles, was a fervent admirer of the English
nstitution as settled by the Revolution of 1688. Montesquieu was, in-
d, the first modern political scientist, and his work gave, in the end,
ew turn to political speculation. From him derive the long series of
itical students of constitutional practice, from Delolme and Hallam
Dicey and Anson.

Montesquieu, however, is chiefly remembered for his doctrine of the
aration of powers, soon to become of vast practical influence in the
nstitution of the United States. In *The Spirit of the Laws* he adapts
n Locke the threefold classification of powers as legislative, executive

and judicial, and declares for the exercise of these three powers by different authorities as the indispensable safeguard of political and civil liberty. It has often been pointed out that Montesquieu misinterpreted the English Constitution from which he thought to derive his doctrine. But the doctrine remains as an extraordinarily influential concept for the political history of the succeeding century.

ROUSSEAU

Hard upon Montesquieu came Jean Jacques Rousseau, following a ver different method. For Rousseau himself sharply contrasts his metho with that of *The Spirit of the Laws*. He is not, he says, like Montesquieu a compiler and comparer of instances. He goes back to the *a priori* metho and seeks to lay down the fundamental principles which underlie al healthy political action and organisation. Returning to Hobbes and Locke he lays hold on the doctrine of the Social Contract as an explanation o the origin and existence of Society, taking from Hobbes the idea o sovereignty as indivisible and unlimited and as arising in Society at th moment when the Social Contract is made ; and from Locke the distinction between sovereign and government, which reserves supreme powe for the whole people as sovereign and makes the government merely derivative authority, always subject to the sovereign people's will. Bu unlike Locke, Rousseau seeks to make his sovereign active in carryin on the work of Society and not merely passive and acquiescent in th work of government. Thus, in Rousseau's hands the theory become fundamentally democratic and the claim is made that the people as whole shall rule in fact as well as in name.

This theory has, however, for Rousseau the effect of a denial that larg States or societies can ever rest on a legitimate principle. He will no agree that the sovereign people can be represented, or can in any respec alienate or delegate its rights. It must, accordingly, legislate for itsel directly ; and this, obviously, can be done only in a society small enoug for the entire people to assemble together. Rousseau, himself a citize of Geneva, thus brings us back to the City-State as the only kind of societ in which the terms of the Social Contract can be carried really into effec

It might be supposed that such a doctrine preached among the Natio States and growing Empires of the eighteenth century could have bee of scant practical effect ; but, in fact, Rousseau's writings exerted a immense influence. For what men learnt from Rousseau was a theory no merely of popular sovereignty but of democratic government as well. H taught them to regard the will of the people as the only legitimate groun of political activity ; and his doctrine of the General Will, obscure as was in many of its bearings, gave political thought a new turn just becau it did stress popular will-power as the creative force in the political fiel Men did not obey Rousseau's behest to restore the City-State ; but did inspire them to make democracy the basis of their political institution

Thus, when the American Colonies revolted from Great Britain a sought for a theoretical foundation for their independence and for practical constitution as its embodiment, they took the forms and arrang ments of their new Republic largely from Montesquieu's interpretati

he English Constitution, but their first principles largely from Rous-
i's *Social Contract*. It was Rousseau, above all, who first made positive
nocracy a live doctrine in the world of politics.

THE FRENCH REVOLUTION

arely was the American Constitution settled on the basis of Mon-
uieu's separation of powers, Locke's insistence on the function of the
e as the protector of liberty and property, and Rousseau's doctrine
ctive sovereignty of the people, than the greater Revolution broke out
'rance and all Europe was plunged into warfare and an intense and
nonious disputation about the first principles of political and human
t. The *Déclaration des Droits de l'Homme et du Citoyen* derives its
s and arguments from Montesquieu, Locke and Rousseau as the
erican Constitution had done; but revolutionary France, ringed
d with the enemies of *Liberté, Egalité, Fraternité*, was soon driven
iscard the separation of powers in favour of an active and extreme
centration of political authority. Rousseauism, and not the doctrines
ocke and Montesquieu, impressed themselves most firmly on France
its admirers throughout the world while the revolutionary epoch
d; and Rousseauism, by insisting on the unlimited sovereignty of
ety, prepared the way for the dictatorship of Napoleon as war leader
e young and threatened Republic.

England and Scotland, while the events in France aroused fervent
pathies of which Tom Paine and William Godwin were the foremost
retical exponents, the practical effect was to strengthen greatly the
e of reaction. The English governing class lived for a generation
er the constant fear of violent revolution and, stirred into panic by
fulminations of Edmund Burke, turned to strong measures of repres-
against every form of Radical activity. The French Revolution gave
English aristocrats the philosophy of which till then they had felt no
, and Burke formulated it for them in noble prose worthy of a better
e. The principles of the Revolution were, above all, an appeal to first
ciples of human reason. Burke met them not by arguments on the
plane but with a denial of reason as the right basis for politics and
sertion of the fundamental importance of a living tradition of political
nade flesh in the accumulated experience of an hereditary governing
. His influence was profound. As far as Conservatism has a philo-
y to-day and is not merely an attempt of vested interests to hold
they have or regain what they have lost, the philosophy of Con-
tism is still the philosophy of Edmund Burke.

was not, however, solely or mainly because of successful repression
England did not after 1789 follow France's revolutionary example.
entire structure and spirit of the two societies was fundamentally
ent. France was an absolute monarchy, under which was an aristo-
class possessed of vast privileges without political power. The circle
is class was, in the main, closed to new men, even if they made for-
in commerce or banking, and the exactions which its privileges
ved weighed down the peasantry with almost intolerable burdens.
taxes were heavy because, largely, of heavy military expenditure

designed to uphold national power and prestige ; and the exemption from taxation of the privileged classes made the taxes weigh heavily on industry and commerce as well as on the common people. Consequently, the rising men, potential leaders of discontent, were not absorbed into the governing class, but left outside to make common cause in the revolution with starving peasants and angry workmen from the towns.

In England, on the other hand, the aristocracy possessed power as wel as privilege, and showed wisdom enough neither to exempt itself wholly from taxation nor to close its ranks against the admission of new men All through the eighteenth century it steadily recruited adherents from the class below it, both by intermarriage and by direct admission of the new rich of commerce and finance. Its own members, as mine-owners iron-masters, owners of flocks of sheep, investors in Bank of England and East India stocks, participated in the rapid economic development of the country. The aristocratic Parliaments of the century were keenly alive to mercantile interests ; and the abundance of rotten boroughs open t purchase by the longest purse enabled rich merchants and others to find their way into Parliament side by side with the representatives of the landed classes. This gave the English aristocracy at once great strength and great adaptability. There was no such concentration of all the force of discontent against the government in England as there was in France France, accordingly, had her Revolution, whereas England, after standing out against any sudden change for a generation, contented hersel with the Reform Act of 1832.

England, which had been the pioneer of parliamentary aristocracy, then slid gently and by stages into parliamentary democracy, which was to become in the nineteenth century the characteristic form of governmen for the developed countries of the world. The Reform Act of 1832 enfranchised only the middle classes, and the working classes had to wai for votes until the further Acts of 1867 and 1884. But from 1832 onward it was clear that the country was heading for a system of parliamentary government based on universal suffrage. It was uncertain only how long it would take to complete the structure of formal political democracy. In fact, it was not quite completed until the concession of Women's Suffrage in 1918 ; and by that time parliamentary democracy was itself being challenged by new forms and theories of government and administration

THE PHILOSOPHIC RADICALS

The theory underlying this gradual change from aristocracy to democracy was supplied, for the most part, in England not by the disciples o Rousseau or the makers of the French Revolution, but by the school o thought known as the Philosophic Radicals. The doctrines of Paine and Godwin were swept away in the panic of anti-Jacobinism which accompanied the revolutionary wars ; and when England at length reformed herself after the peace their echoes had grown faint. It was Jeremy Bentham, and not William Godwin, who set his seal to the Reform Act of 1832

Benthamism was, indeed, and remained for the rest of the century, th most powerful influence on English political thought and action. Bentham and his followers, the Utilitarians, or Philosophic Radicals, had n for Social Contracts or National Rights or for any *a priori* judgments ept their own peculiar views about human nature. Their sole test of itical right was expediency, and on this alone they professed to base ir democratic case. But in fact expediency, or utility, of course, de- nds a prior standard of judgment ; and in postulating as the end of itics the greatest happiness of the greatest number the Benthamists e really assuming a conclusion utterly at variance with what Burke believed or England acted upon thitherto. They were assuming, to in with, that any man's happiness ought to count for as much as any er's ; and they were assuming, too, that what mattered was the happi- s of individual men and women and not any well-being of Society as hole, distinguished from the individuals who composed it. Their *riori* doctrine thus embodied a democratic individualism, and their ceptions of utility could be made operative only upon this plain umption.

enthamism began as a destructive and critical doctrine. It was, above a great solvent of established dogmas and institutions. While Napo- n was sweeping the petty kingdoms and principalities of Europe free eudal survivals and equipping them with the foundations of a new simplified legal code, the English Benthamites, rejecting all high- nding gospels of human rights, were criticising one institution after ther by asking the simple question : “ How far does this thing minister he increase of human happiness ? ” And in face of the vast concurrent nges in economic conditions and social needs, one institution after ther was going down before their criticism like a house of cards. It is y to see now that they were far stronger as critics than in construction, that their attacks on the old privileges and restrictions left the way r for an unrestricted capitalist development that brought with it new blems of its own. But their work of destruction was none the less ispensable, and their principle of the greatest happiness of the greatest nber was readily capable of being turned to constructive purpose when time was ripe. The writings of John Stuart Mill in the middle of the tury well mark the transition ; for Mill hovered long between the two osing interpretations of the Benthamite creed.

he Philosophic Radicals and their political allies and successors of the anchester School ” hustled England into the full acceptance of the pel of *laissez-faire*. Seeing the new economic system that came in with Industrial Revolution through the eyes of Adam Smith and Ricardo Nassau Senior, the great Victorians thought to foster human happi- s by persuading the State to let economic conditions take their own rse, convinced that some sort of preordained harmony of things would g happiness and the common good out of the private self-interested ings of individual men. Equally with Locke, these great Victorians ired to restrict the sphere of State action and to give free rein to private ative. But Utilitarianism had the merits as well as the defects of its trine of expediency. If *laissez-faire* in industry and commerce came of it, so, in some degree, did the movement for social reform ; for it impossible to survey, for example, the state of public health and tation in England without desiring to apply remedies in the cause of an happiness. Edwin Chadwick's great Reports on the health and housing of the urban poor in the eighteen-forties are landmarks in th history of social reform; and long before the structure of *laissez-faire* wa complete the State had begun upon a new career of intervention in th spheres of factory inspection, public health legislation and similar mea sures of social justice.

These, emphasised in the writings of John Stuart Mill, constitute th constructive outcome of the Benthamite gospel; and much of the bes of modern social legislation can be traced back directly to this influence But the new forms of constructive State intervention rested always o a basis of demonstrable necessity. For the Benthamites the presumptio was always in favour of letting things alone; intervention was justifie only if clear proof could be given of abuses that could not be remedie without the action of the State. The Benthamites remained to the en individualists, trusting, on the whole, to the free play of economic force to increase the welfare and happiness of Society.

HEGEL AND MARX

Meanwhile, on the Continent of Europe political thought had bee developing along very different lines. When Europe settled down aft the revolutionary wars the dominant school of thought came to be fo a time the Hegelian—developed by Hegel out of Kant, and by Kant ou of Rousseau. As against the Utilitarian glorification of *laissez-faire* an private initiative the Hegelian doctrine glorified the power and authorit of the State, bidding the individual seek to realise himself not in his ow private concerns alone but far more and more fundamentally in an through his contribution to the life of the State. The State was, indee for Hegel a mystical being—an end in itself to which the separate indiv duals who at any time made it up must contribute according to the capacity, and in which they themselves would realise the best in life.

This metaphysical theory of the State has obvious affinities to th view preached by Burke in his diatribes against the French Revolutio for both make the claims of individuals subordinate to the well-being the State itself as the highest good, and both are strongly imbued with a historical attitude which sees in a continuous tradition belonging to th State the highest incarnation of human value. It has also obvious te dencies towards autocracy, in that it emphasises the State's unity an preaches therewith a gospel of subjection, and towards aristocracy, in th it emphasises the inequality of different men's capacities for service the State rather than the equality of human needs. It leads readily, mor over, to a judgment of the virtue of the State according to its powe and therewith to a glorification of war and Empire as means to the sel realisation of the State. And, above all, regarding the State as the highe form of human achievement and value, it denies the aspiration towar human brotherhood over the whole world and leaves State ranged again State as man was ranged against man in Hobbes's imagined conditi of Nature.

More than enough has been written of the impression which the Heg lian view of the State made on the formative minds of nineteenth centu Germany to make it unnecessary to stress the point here. What portant for our purpose is that out of German Hegelianism, inverted and apted to a very different purpose, came the new conception which, as e century advanced, was to challenge both Prussianism and the com- cent parliamentary democracy of Victorian England. Marxian So- lism took much of its shape, though not its content, from the teaching Hegel. For Hegel progress consisted in the gradual realisation of the dea," of which material things and conditions were but the reflection. is process was at every stage a conflict in which the dominant idea met th its opposite, its contradiction, until out of the contention came a sion of old and new, creating a synthesis, a higher idea blended of the o and destined to be superseded by a similar process of conflict in its n.

Karl Marx took this evolutionary conception and turned it upside wn. For him the determining factor was not the "idea," but the terial equipment of Society, for ever dictating new methods of pro- ction and new social and economic arrangements designed to further ir development. This doctrine is the Materialist Conception of story which makes the "powers of production," in their ceaseless elopment, the true cause of changing social structures and class rela- nships in Society. As the "powers of production"—the material re- urces at man's disposal, and man's knowledge of their use—develop m stage to stage, different forms of economic organisation are re- ired, and from these follow different arrangements of social classes d different distributions of power. At one time the main power be- ged to the great landlords ; and Society was constructed in accordance h their needs. Then came industrial and commercial developments ich made the traditional authority of these landlords obsolete ; and in e time the upper strata of the industrial classes—the employers—after nting their way against the opposition of the old governing class, were ited to share in its authority, and a new governing class based on the ion of the two came into being. But, in order to develop the productive ources at the disposal of Society, the industrial capitalists were com- led to gather the workers together into factories, and to subject them to ommon discipline of production. This inevitably gave these workers wer and opportunity to organise against their masters : in other words, reated the modern Labour Movement with its growing challenge to italist demands and assumptions. In the end, according to Marx, this ject class, to which the rights of organisation and protest cannot be ied, is destined to overthrow the capitalist class and Capitalism as an nomic system. It will do this, Marx holds, because it is better fitted n the class which it supersedes to make full use of the developing vers of production that are at men's command. But with the victory he proletariat there will remain no subject class to be exploited ; and h the coming of a classless Society exploitation will cease, and the ernment of class by class give place to the social administration of the munity's resources in the interests of all.

his is obviously not the place for any account of Marx's economic ories. What concerns us here is his conception of their political re- ons. But it is difficult to keep the two apart because for the Marxist tics is not an independent science, but only a study of the reflections of

economic causes in the political sphere. The State is not a self-subsistent
reality, based on any real solidarity of the community as a whole, but only
an emanation from the class-relationships which exist in the economic
sphere. It is merely an " executive committee for administering the affairs
ot the ruling class as a whole." Accordingly, as long as Capitalism continues to exist, the Marxist holds that there can be no real democracy
however widely the franchise may be extended ; for it is meaningless to
speak of equal political rights among men who are subject to gross economic inequalities. The cherished democratic conceptions of the nineteenth century are thus swept away with the wave of a hand ; and the
demand for true democracy is based on a demand for the abolition o
economic inequality and class exploitation.

This theory has powerful repercussions in the sphere of political practice ; for it means that as the State is a reflection of the dominant economic
class, each new class that rises to power on the basis of the changing
forms of production needs to remake the State in its own image. The
workers, according to Marx, need, not merely to capture the existing
State and use it for their own ends, but to destroy it together with the
class which it represents, and to set up a new institution in its place
Marxists, agreed so far, differ widely among themselves concerning the
nature of this new institution and the method by which the replacement i
to be achieved. The orthodox Social Democrats of Germany and many
other countries take one view and the Communists take another—both
schools of thought claiming that what they advocate is the only tru
Marxian view. It will, however, be more convenient to discuss thi
problem at a later stage when we come to deal with the doctrines and
conflicts of the twentieth century ; for it is in our own day that th
divergence between Communism and Social Democracy has com
dramatically to a head.

Marx's doctrine was clearly outlined as early as the Year of Revolu
tions, 1848, in the famous *Communist Manifesto* which he and Engel
published in that year. But Socialism, or Communism, was not stron
enough at that stage to provide the central issue of the European struggle
Though Socialism of one sort or another figured in the movements o
1848 in both France and Germany, the main conflicts of that year wer
based rather on attempts to establish parliamentary democracy or t
secure national unity and independence than on any bid of the workin
class for the overthrow of Capitalism. France established a bourgeoi
Republic which was speedily replaced by the bourgeois Imperialism o
Napoleon III. In Germany the Frankfort Assembly made an unsuccessfu
attempt to achieve at once national unity and constitutional democracy
In England Chartism flickered out and died before the self-confiden
parliamentarism of the new British governing class. The time was no
ripe for Socialism to take the centre of the stage ; and Marxism had t
wait its opportunity. The influence of the *Communist Manifesto* came i
two later movements—the rise of Social Democracy after the foundatio
of the First International in 1864, and the rise of Communism after th
Russian Revolution of 1917.

Ieanwhile, after the suppression of the revolutions of 1848 Europe ped for herself a different course. In the realm of political theory rwinism produced a deep effect, by imbuing thinkers with an organic ception of Society. Very different conclusions were drawn by different ters from the Darwinian ideas. Some, like Herbert Spencer, stressed factor of the struggle for existence, and based on evolutionary conts an idea of Society as the scene of a permanent struggle, in which the st would survive if natural forces were allowed to take their course. s doctrine developed into the purest and crudest Individualism and d itself with the economic school of *laissez-faire* to oppose every exion of the powers and intervention of the State. But, on the other , writers such as Huxley regarded it as the mission of Society to trol and supersede the struggle for existence, making of the comity not a jungle, but an ordered garden ; while Prince Kropotkin in *Mutual Aid* sought to derive Communism from the biological neces- of co-operation among men and animals. Other writers seized on the ception of Society as an organism and used it to demand the conated control of all the parts of the community by the State, as a 's brain co-ordinates and controls his entire body. In the long run the latter conceptions were the more influential ; and the growth of nce did make for strengthening the movement towards the conated control of the life of Society. But in the later Victorian era ogical analogies were over-simplified and over-stressed on both sides e argument by individualists and Socialists alike, until the critically ded became sick of analogies and set out to find a new basis for the y of Society either in the classification and comparison of actual social itutions, or in the attempts at a scientific study of the structure and king of the human mind.

ANTHROPOLOGY AND PSYCHOLOGY

he first of these two methods received, in the latter part of the nineth century, powerful reinforcement from the growth of Anthrogy, and the more intensive study of the social institutions of primi- peoples past and present. The work of the followers of Spencer in field, of Sir James Frazer, Professor Westermarck, L. T. Hobhouse, a host of American and Continental scholars—Professor Ross, for nple—threw a world of new light on the mind and social organisation rimitive peoples and drew theoretical students of politics away from ure rationalism of the earlier schools of the eighteenth and nineth centuries to a more realistic way of looking at the actual institutions behaviour of advanced as well as primitive peoples. This new stream fluences mingled readily, as in the work of Dr. Rivers, with materials similar tendency drawn from the growing study of psychology. The of William James provided a mass of material ready and waiting for ication to the social field ; and in their very different ways Professor ougall and Professor Graham Wallas laid hold on this material and ed it to the creation of a new study of Social Psychology. And later in the new century the work of Professor Freud also began to make its mark on the shape and content of political theory.

This explanation of the psychological basis of politics took many different forms. Some writers, like McDougall, directed their attention mainly to a study and classification of the social instincts in men, discussing rather man as a social animal than the actual political and social institutions in which he embodied his social instincts and desires. Others, like Professor Wallas, began rather at the institutional end and studied the actual working of parliaments, committees and associations from a realistic standpoint, using the data—often none too clearly formulated by the psychologists—of individual psychology as the basis for a theory of the psychology of Society itself.

Whatever the angle of vision might be, the positive effect of all these new ways of approach—anthropological and psychological alike—was to make men far more sceptical both of answers to the social question which purported to lay down any universally right form of social organisation independent of considerations of time or place and of any purely rationalistic approach to the problem of politics. This does not mean that the anthropologists and psychologists generally set out to proclaim the advantages of irrationalism. Far from it! Some of them—Professor Wallas, for example—remained convinced rationalists in that they saw in the advance of human reason to the control of social life the main mark of the progress of civilisation and the chief hope for the future of mankind. But while they might still put their trust in reason, they were led by the new influences to regard the actual working of present and past forms of Society in a far less rationalistic spirit and to make, at the least, far greater allowances for the irrational in man as a necessary element in the working of any possible Society. Their entire standpoint came to differ radically from that of Godwin, on the one hand, or Bentham, on the other, or even from that of John Stuart Mill or T. H. Green. They came to recognise that much of men's social action was, and must be, under any Society instinctive rather than rational, and that forms and projects of social and political organisation must be judged not in the light of pure deductive reason but in relation to their appeal to men's instincts and passions.

POLITICAL PLURALISM

Some schools of thought, profoundly influenced by the new ideas that were in the air, went much further than this. The opening decade of the present century was marked by a revolt, in theory and practice alike, against the over-simplified conceptions of purely parliamentary democracy. This revolt found shape and substance in certain other studies and in certain practical movements which seemed to fit in closely with the new teachings of the psychologists and anthropologists. A revival of mediæva studies, in the hands of Gierke in Germany and F. W. Maitland in Great Britain, served to emphasise the importance and spontaneity in mediæval Society of institutions and associations which expressed a large part of the spirit of community, but in no sense owed their being or thei authority to the creative fiat of the State. The State thus came to be regarded not as standing for the whole organised life of Society, but as one

ong a number of social institutions and associations, of which each
bodied in its degree some part or element in the total life of the com-
unity. Herbert Spencer’s direct and simple opposition between “ the
an ” and “ the State ” was thus transcended and half obliterated in a
w view of the community as finding expression in a complex body of
cial institutions and relationships, among which the State might be
st but only *primus inter pares*. Political Pluralism came into fashion,
allenging the old unitary conceptions of political obligation and the old
nple contrast between sovereign and subject.

It was no accident that these new views began to gain ground just at a
ne when certain forms of voluntary association were powerfully chal-
ging the supposed absolute authority of the Sovereign State. In face of
rise of large-scale capitalist combines, America and Europe were
ding that it was easier to pass laws against trusts than to secure their
forcement, and that great aggregations of capital directed by small
ups of powerful financiers held, in practice, an authority over public
icy and the lives of men that ordinary measures of legislation were
nost helpless to counteract. Moreover, mass production and large-
le capitalism were calling into existence no less large and influential
nbines of manual workers. The Trade Unions, which Victorian jurists
l been content to regard as the mere tolerated creatures of the State,
ssessing only so much of right as the State law chose to accord them,
re coming to assert themselves as independent powers, claiming a right
act on behalf of their members and to strike even in defiance of the
te’s prohibition.

n the years before the War of 1914 a wave of Labour unrest swept
r the industrialised world. Syndicalism in France and Italy, Industrial
ionism in the United States, and Guild Socialism in Great Britain,
e all incarnations of a new Labour spirit hostile to the traditional con-
tions of parliamentary democracy. Germany indeed, divided between
Hegelian Imperialism and a Social Democratic interpretation of
rxism, seemed to be little touched by the new ideas ; but elsewhere
y were, in 1914, making a powerful appeal to the younger generation.
e and all, despite their very great differences in other matters, these
theories and policies stood for a conception which sought to base
new life of a recreated Society, not on a parliamentary state, but on
spontaneous life of a variety of associations primarily economic, and
nded on the idea of function, or work, as the source of creative vigour
he community. A new conception of functional democracy, with a
rsified social structure at its back, came to challenge the “ one man,
vote ” conception of parliamentary democracy.

hese movements were echoed, and paralleled, in other spheres.
rchmen, under the influences of J. N. Figgis, protested against the
stianism of the Church Establishment, and sought to re-animate
gion by giving it a recognised place in the life of society independent
nd co-ordinate with, the life of the State. Free Churchmen, such as
Orchard, began to think along the same lines ; and modernists and
amontanes were alike influenced by the new ideas. The years before
War were everywhere fertile in plans for reorganising the life of society
basis not of “one man, one vote” but of the recognition of the

community as a related complex of distinct functions, each needing a distinct and self-governing organisation of its own.

In the economic sphere the thought of Georges Sorel in France made of this new view an activist philosophy of social life. The old conception of merely voting citizenship was denounced as essentially passive and uncreative ; and men were invited, in the name of active citizenship, to realise themselves in and through a host of functional associations in which they could perform positive service. Spontaneity of action, free expression of personality were stressed, in preference to any rationalised ordering of the life of society according to a simple intellectual plan. It was insisted that men would be moved to action, not so much by rational arguments, as by emotional appeals, or appeals to instincts of solidarity and self-expression, made practical in “ social myths ” such as the syndicalist myth of a “ General Strike.”

It is, of course, easy to exaggerate the direct influence of theories like those of Sorel in France or the Guild Socialists in Great Britain on the mass of the people. Neither Syndicalism nor Guild Socialism, as a theory ever extended beyond a comparatively narrow circle. But these schools of thought did serve as interpreters of what was passing, far less consciously or articulately, in the minds of ordinary men. There was widespread disillusionment with the results of Parliamentarism, and a growing tendency to rely on forms of special functional association and on “ direc action ” in some shape for the achievement of political and economi ends.

WAR AND REVOLUTION

The War took Europe at a time when these new ideas were still in th stage of being formulated, and made the basis of positive theories an methods of action. Momentarily, it interrupted both the process o thought and the tendencies towards positive action in the economi field. But actually war-time experience, while it added immensely to th powers and activities of the various States, and made them for the tim being the focusing points of the entire national effort, at the same tim reinforced the realistic views we have been describing. For the States, i order to mobilise their several national resources, found themselves compelled, in practice, to call in the advice and assistance of a host of functional associations, and to take such bodies in varying degrees into partnership, or use them as agencies for the execution of the national policy Associations of traders and manufacturers on the one hand, and Trad Unions on the other, found themselves regularly consulted and enrolle in the national service, while such movements of opposition to the Wa as existed in the various countries could only find strength and expressio by organising themselves in voluntary societies of protest and agitation either in the political or in the economic field. When, after the War, th States proceeded, as quickly as they could, to divest themselves of the added war-time functions, and to promote a return to the *status quo an bellum*, the associations which were thus sundered from positive administrative functions within the State were left far stronger and with fa more desire for a share in authority than before the War. There could b in fact, no real return to the old conditions, for the War had radicall ered both the political and economic configuration of the world, l the real structure of the political societies and economic units of ich it was made up.

Aoreover, war had been the signal for revolution. In Germany the gelian Empire had gone down in defeat, leaving the German people h prostrate under the victors and doubtful and divided about the form he new society that should take its place. If, for the moment, the form pted was that of parliamentary democracy under the initial guidance he Social Democratic Party, this was far less because these things really nmanded the allegiance of the German people than because there was hing else available. The fall of the Hegelian Empire left a great blank he political consciousness of the German nation ; and ever since 1918 rman politics have reflected the chaos of this consciousness. There is , in 1931, no approach to a solution of the problem of German governnt.

'ar greater and more influential than the German Revolution, because ed on the clear conception of an alternative way of government, was Russian Revolution of 1917. The fall of Russia's half-civilised dessm was, indeed, followed at first by the rule—or failure to rule—of a rernment not unlike, in many of its features, the Government of rt and Scheidemann in Germany. But the episodes of Lvov and ensky were brief, and, within a few months of the collapse of Czar-1, the Bolshevik party under Nikolai Lenin had seized power and ed to all the governments of the world the most authoritative lenge since 1789.

COMMUNISM

1 order that we may understand what took place in Russia, and its istent and growing influence on the world as a whole, we must go t to what was said earlier on about the doctrines of Karl Marx. For sian Bolshevism, or Communism, is simply Marxism reinterpreted in ns of the conditions and ideas of the twentieth century. We have seen , after Marx's day, while his disciples remained broadly in agreement ut the basis of his economic doctrines, they differed widely about their tical and political implications. The German Social Democrats and y other parties founded upon the German model (including the sian Mensheviks) set to work to create parliamentary Socialist parties, to use these parties, as opportunity arose, for the advocacy and ncement of particular social reforms, with the aim of a gradual quest of the State and a gradual transformation of Capitalism Socialism by a succession of legislative measures changing, bit by the character of the organised life of Society. The Bolsheviks, on the r hand, offered a radically different—and, in my view, a far more ect—interpretation of Marx's teaching. The capitalist State, they ind, could not be captured and applied to Socialist uses. It would have e overthrown ; and the victorious workers, or their leaders in the ggle, would then have to create in its place on the morrow of the lution a new State of an utterly different kind and spirit, designed to e their own utterly different ends.

his new State, however, could not itself be, in any full sense, Socialist or Communist. To the mind of the Communist, indeed, the idea of a Communist State is a contradiction in terms ; for to him the word “ State ” connotes an instrument for the coercion of one class by another, and with the full coming of Communism coercion of class by class will have disappeared because there will no longer be any classes at all. Under Communism, its adherents say, there will be an administrative machine but not a “ State.”

But for some time after the successful overthrow of the capitalist State, the Communists tell us, there must be a State of a radically different kind. For Societies cannot pass straight from Capitalism to Socialism. There must be an intervening period during which the victorious proletariat first consolidates its power, defends itself against the onslaughts of counter-revolution and completes the extermination, or merging in itself, of the dispossessed old ruling class, and then accustoms itself to the new classless way of living, and builds up for itself the social habits and forms of organisation necessary for the free functioning of a classless Society. This is the period known as the season of the “ dictatorship of the proletariat ”—a phrase quoted from Marx's own writings—the period through which the Communists claim that Russia, fourteen years after the Revolution, is still painfully passing.

This idea of dictatorship occupies a key position in the theory o Communism. In their ideals about the new Society at which they are aiming, the Communists do not necessarily differ at all from other Socialists who look forward to complete Socialism as the next stage in social evolution. Their difference is one of method and not of final objective. They believe that the cleavage between the old Society and the new must be sharp and absolute, that the new must be built right up from freshly-laid foundations and in a fresh environment carefully prepared for the minds of men, and that the building of it must be undertaken by a State wielding almost unlimited authority, acting on behalf of the proletarian class, and destined to “ wither away ” as soon as the work o Socialist construction has been solidly achieved. There is to be a period of transition between the fall of Capitalism and the establishment o Socialism ; and during this period the proletariat must be “ dictator,” using as its instrument a specially constructed State of its own.

A class, however, cannot dictate directly, or in its own person. It may indeed, take the place of the “ sovereign people ” of earlier theories standing behind and sustaining the Government by its organised will power. But it cannot be the Government, or even directly appoint it o tell it what to do. Between the proletariat and the actual executive Government, accordingly, there must be a mediating body, an organised collective expression of the will of the proletarian class. This, accordin to the Communists, is the function of the Communist Party, open to a class-conscious proletarians who have the will to share in the work an responsibilities of the new governing class.

Out of this idea arises the dual system of government in contemporar Russia. The proletariat is there represented twice over—as a sovereig class in the system of local and district Soviets, up to the national Sovie Congress of the entire U.S.S.R., and as a governing class in the Communist Party, to which the flower of the proletarian class belongs.

Jnder this arrangement it is, in effect, the Communist Party that ates and decides upon major questions of policy ; and the Congress Soviets, while it formally holds the supreme legislative power, serves er as a means of broadcasting throughout the U.S.S.R. the policy ch the party has already laid down. The Congress, it should be noted, ot, like the Parliaments of Western Europe and America, a body in e or less permanent session, but an occasional gathering of delegates, esented between sessions by a Præsidium with which the executive n, the Council of People's Commissaries, and the Political Committee ne Communist Party keep in close and constant contact.

he Soviet Constitution and the actual methods of government in the .S.R. alike run directly counter to the basic assumptions of parlia- tary democracy. The franchise in Russia is, indeed, very widely ised ; but it is a class franchise, from which those who belong to the ploiting " classes, including private traders and the *kulaks* (or rich ants), are excluded. Its principle is not " one man, one vote," but er " one worker, one vote." Moreover, the Communist system repu- es the secret ballot which has been regarded as the necessary comple- t of the wide franchise in parliamentary countries. The local Soviets elected and elect their representatives to regional and national Soviets Congresses by open voting ; and very often this means that the ial Communist list of candidates is chosen *en bloc* and without osition. The object, one must understand, is not to reflect individual ions, but to secure the adequate representation of a class interest and t of view. Accordingly, the Communist Party dominates the elec- s. The representation, moreover, is weighted in favour of the urban kers in order that they may not be swamped by Russia's vast peasant ılation ; and this weighting adds in practice to the electoral influence ne party.

'e have thus, in the U.S.S.R., an avowedly partisan State founded on ass basis, but conceived, not as the ruling instrument of a finished alist Society, but as the instrument of the gradual transition to such ciety. The measures designed gradually to exterminate the private er and the *kulak*, the campaign for the socialisation of agriculture, the Five Years' Plan of intensive industrialisation, are all conceived eps on the road to a Socialist system which, when once it has been eved and consolidated, will render unnecessary the existence of the -State, because it will have made an end of the existence of classes.

here a word of caution is necessary. For the Communists the Rus- Revolution was, and remains, not an independent national movement gned to lead to the creation in Russia of a Socialist Society, but a part agment of the World Revolution without which its victories cannot onsolidated or made secure. The class-State in Russia will continue e needed as long as the existence of capitalism outside Russia still the U.S.S.R. with the risk of Counter-Revolution, or as there ins anywhere in the world a section of the proletariat still awaiting ncipation. Thus, the disappearance of the State in Russia is postponed e indefinite future ; and all peaceful relations of the U.S.S.R. with apitalist world outside are but truces in a class-war that can end in a world made safe for Socialism.

Nevertheless, within the U.S.S.R., the Communist Party is already striving to build up organs of economic administration which will in time become self-acting, without the need for political control. The “ Trusts ” which conduct State industries, the planning Commissions an controlling Councils which direct and co-ordinate the economic life o the country, the Trade Unions and Co-operative Societies which have been given a recognised place in the system of administration, are the true organs of social control which are destined to replace and outlive th class-State and the dictatorship of the proletariat when the time comes fo political government to be superseded by economic administration.

Such, in broad outline, is the Soviet system, with the hierarchy o Soviets from those of village and factory up to the Central Congress, wit its parallel hierarchy of branches, committees and Congresses of th Communist Party, with its Five Years' Plan and its third hierarchy o economic bodies responsible for its execution and, above all, with it perfervid faith in the power of men to be stirred to continuous actio and service by means of a compelling mass-appeal. For this attempt t enlist the conscious will and enthusiasm of the proletariat on the side o the new system, to persuade men to work as well as to fight hard for th consolidation of the new Society, to create a community consisting o active instead of merely voting citizens on the basis of an equalitaria appeal, is, far more than the dry constitutional structure of the ne Russia, the essential feature of Communism. The Five Years' Plan, wit its effort to speed up industrialisation at the cost of keeping down th immediate standard of life, puts on the population of Russia, and particularly upon the urban workers, a strain which would be clearly intolerable unless there were faith behind it. The Five Years' Plan, and th Soviet scheme altogether, can succeed only if it is true, as the Communis believe, that proletarian faith can move mountains. Yet—hard as it is get authentic information—the Plan does seem to be succeeding so far.

FASCISM

It is natural to compare with Russian Communism the other new for of political organisation which is challenging parliamentarism in contemporary Europe. Italian Fascism has, in terms of method, certain featur in common with the Russian system—above all, its insistence on activi and not passivity as the function of citizenship, its attempt to exclu hostile elements and doctrines from any share in the control of the Stat and even from any effective means of expression, its desire to co-ordina under the banner of the State all active forms of voluntary associati and all important forms of communal life, and its determination to gi the Fascist Party, whatever the nominal character of the political syste the dominant place in the determination of policy. The methods Fascism and Communism are, in many respects, closely akin ; but t ends which they set before themselves are, of course, radically differe

For they are based on two radically different and conflicting concep For the Communist, schooled in Marxism, the underlying reality is t reality of class, and upon class must the foundations of the new Soci be built. But for Fascism the underlying reality is the Nation—t

Vational Idea," and the end of politics is to make the Nation great and
find a political organ which shall be expressive of the entire national
. As the ideas of Marx and Mazzini clashed in the making of the
ernational Working Men's Association of 1864—the "First Inter-
ional"—so the ideas of Nationalism and of Marxist Socialism are at
iance in the world to-day. But the clash is more violent because Na-
nalism is for the Italians, and for most of the peoples of Europe, no
ger something to be won by victory over a foreign oppressor, but a
ng possessed already in form, but needing to be made flesh and guarded
inst the onslaughts of Internationalism and Socialism.

talian Fascism, created by the ex-Socialist, Benito Mussolini, arose
of the chaotic faction-fights of post-War Italy. Parliamentary govern-
nt had there been always weak and vacillating; and, in face of the
ng influence of Socialism during and after the War, it had become
ctically impotent. It was almost true that Italy was not being governed
ll, and that no one had either power or will to make or to enforce the
s. The Socialists, for their part, were powerful enough to paralyse
ernment, but not powerful enough to take it into their own hands;
they had little hold on the agrarian South, and feared that their seizure
uthority in the North might only lead to a prolonged and disastrous
l war, in the course of which they might easily be starved into sub-
sion by foreign blockade. Consequently they hesitated, refusing to
k the old system, and not daring, despite their sympathy with Russia,
nstitute the new. As in Germany and France, no great Socialist leader
se to guide their policy, and they floundered helplessly. The Govern-
nt, in even worse case, floundered too, until there set in a general dis-
t with the failure of parliamentarism, combined with a loss of faith in
Socialist alternative. For a time, it seemed as if this situation might
l to the triumph of the progressive Catholic Party of Don Sturzo—
Popolari; but the Party, lacking a clearly defined policy or a wide
ugh basis of working-class support, fell also into impotence. The road
left clear for Fascism, to which all manner of discontented elements
an to have recourse—from Syndicalists of the extreme left to militant
militarist Nationalists of the extreme right. D'Annunzio's Fiume
enture, with its fanciful devising of the Constitution of Cornaro and
appeal to Italian irredentism and disappointment with the spoils of
War, brought in a host of new recruits; and the situation which arose
n the Italian Socialists and Trade Unionists, having declared a great
e and occupied the factories in defiance of the Government, drew
k and refused to attempt to take government into their own hands,
pleted the discredit of the Socialist leaders. Rome was thereafter any
ng man's for the taking; and it was not long before the King went
to Fascism, and the Fascist march on Rome registered the passing
uthority into the hands of Signor Mussolini.

ascism was, at this time, a call to action rather than a theory or a pro-
mme. It could be defined in terms of its "hates," but hardly of its
tive doctrines, save that it was nationalist, that it appealed chiefly to
h, and that it laid stress on action rather than thought as the vital
ter. It hated Communism, and all forms of internationalism and class-
are. It hated parliamentarism, which it denounced as the cause of

Italian impotence and mismanagement. It hated pacifism, because it set limits to the range of Italian ambition, and denied the ultimate validity of the nation and of nationalist morality.

On this somewhat slender basis of hates and loves, Fascism has gradually built up for itself a comprehensive, if not always clear or consistent, political theory and outlook. This theory bases itself, first and foremost, upon the idea of the Nation as the ultimate moral being. To the Nation all things and persons are to be subordinate, and in and through the Nation they are to seek their self-realisation. Men owe duties to the Nation ; but the Nation itself owes no duties. It may have dealings—peaceful and friendly as well as warlike and inimical—with other Nations ; but it recognises no superior to itself, and no subordination to the family of Nations of which it is a member. In an almost Nietzschean spirit, it seeks self-expression and expansion, so that the world's peace depends on nothing getting in the way of its ambitions. It is in this thoroughly Hegelian and metaphysical. For those who accept it, the Nation is the universal ; and the object of politics is national self-realisation.

This means Imperialism without, for the Nation must have room to breathe and to expand. It involves, accordingly, an extolling of the military virtues, and a constant militancy of tone among Italian diplomats. This does not necessarily mean that Italy wants to go to war, unless she can find an opponent she is quite sure to beat ; for Fascist Italy preserves, amid all her high-sounding talk, a fair share of practical common sense. But it does mean that Italy must always be contemplating war as a possibility, and must never put herself in a posture of pacifism even when she means to keep the peace.

The National Idea means, in addition, concentration within ; for the entire life of the Society must be grouped and organised, as far as possible, around the Nation-State. In particular, no organ of action or expression must be tolerated within the community unless it is prepared to yield homage to the National Idea, and to co-operate in its realisation. This involves especially the destruction of the Labour Movement, in the form which it has spontaneously assumed in Italy, as in other countries ; for the working-class, like the Capitalist system, takes much the same shape in all industrialised countries, and is essentially " tainted " with internationalism. Trade Unions and Socialist Parties alike have their international affiliations, and pay homage to the idea of international class solidarity. Accordingly, Fascism must root them out ; but it cannot do this unless it is also prepared to replace them ; for there must in modern Society be means of organised expression for working-class needs and unless these are recognised and granted, they will inevitably take forms hostile to the desires of those who seek their extermination.

Fascism, therefore, in destroying the established working-class in Italy set out to replace it by a new movement made in the Fascist image. Instead of Socialist Trade Unions, there should be Fascist Unions, officered by approved supporters of Fascism and refusing admission to all malignants and recusants. Upon these bodies wide powers should be conferred including the power to levy contributions on non-members as well a members. They should be given exclusive recognised rights of collectiv bargaining with the employers ; and they should be grouped with th rresponding employers' associations in State-recognised Corporations the supervision of each industry or service as a whole. And, finally, part of a general change in the structure of the Fascist State they, in-ad of the old geographical constituencies, should serve as electoral lleges, along with other functional bodies, for the choice of members the new Fascist legislature.

Gradually, the Fascist Government has carried these ideas into effect. has founded, organised and endowed with special privileges and hority Fascist Trade Unions and Employers' Associations, Fascist rporations made up of both elements, Fascist Professional Associa-ns and Co-operative Societies—in short, it has given to every possible m of voluntary association a Fascist basis, making each an organ of Fascist State in its own sphere, and carefully ensuring that each shall officered and controlled only by adherents of the Fascist Party. How this system has really come to command the allegiance of a large sec-n of the Italian working-class it is not easy to say ; for it is an essential t of Fascism, as of Communism, to forbid free expression of hostile nion. It has, at any rate, held fast so far, and prevented the effective ival of contacts between the workers of Italy and the organised Labour vements of other countries.

THE CORPORATIVE STATE

This idea and policy of Fascism are commonly described as the idea policy of the " Corporative State." The Fascist State is conceived onsisting, not simply of so many individuals, but of these individuals uped, according to their several functions, in a number of Corpora-ns through which they are related to, and take their part in, the life of State. Under the State itself the Corporations form the next order of lity, and in them, under the State, the life of the Nation must be ressed.

This conception has evidently much in common with the political ralism described earlier in this Article, in that it recognises the reality unctional association, and the necessity of according to it a recognised ce in the organised life of Society. But the Fascist idea is at bottom ically different from such pluralistic conceptions as Guild Socialism ; Fascism simply seeks to make its Corporations subordinate con-utors to the life of the Nation-State, which is essentially unitary and ereign. Pluralism, on the other hand, denies the State this over-riding ction, and thinks of voluntary associations as independent and spon-ous bodies, capable of acting against the State as well as with it, and o sense its creatures. Guild Socialism and Syndicalism laid stress on dom rather than order : Fascism has the Hegelian preference for order, bids men realise their freedom in the freedom of the State rather in their individual or corporate capacities.

n the nineteenth century, Nationalism commonly appeared as a creed d with some form of Liberalism, and fighting at once for national ncipation and unity and for guarantees of constitutional government rding to the formulæ of parliamentary democracy. But it has been mmon experience that, when once a people has achieved national unity under a parliamentary system, Nationalism is apt to seek a new political creed, and to become the ally of extreme Conservatism rather than of the more democratic parties. Thus, before the War, German and Italian Nationalism were both represented by the parties of the extreme Right, while French Nationalism found its most characteristic expression in the anti-democratic and royalist groups, and especially in the *Action Française* of Charles Maurras and his followers. This tendency has become even more marked since the War; above all in the growth of Fascism, absorbing the old Nationalist Party in Italy, and in the so-called "National Socialism" of Herr Hitler and his associates in Germany. The Nationalists everywhere have moved away from parliamentary democracy, and towards some form of dictatorship; while, at the other extreme, the Communists, from a point of view predominantly international, have challenged parliamentary democracy no less insistently. The defence of the nineteenth century tradition has thus been left to the parties and groups lying between these extremes, including the middle-class parties tinged with Liberalism, and the orthodox Social Democratic and Labour Parties; and these middle groups have, in many countries, been forced into an uneasy and paralysing alliance for the defence of forms of government which they desire to use for widely divergent purposes. Any alliance of this sort runs, however, a grave danger of practical sterility; and this sterility is apt to drive hesitant elements in the electorate towards one or other of the two extremes. Parliamentary democracy is thus furthe weakened, or even compelled, as in Germany to-day, to defend itself b temporary recourse to the expedients of those who assail it. The presen German Chancellor (1931), for instance, has been driven to send th Reichstag home, and govern by means of a temporary dictatorship i order to preserve the post-War German political system from the dange of dissolution. Great Britain is almost alone in post-War Europe in havin to face, so far, no important threat to its established system from eithe Right or Left; for Fascism and Communism have alike failed so far t make any real impression upon the British mind. But even in Grea Britain there has been a decay of faith in Parliament, manifested rathe in a significant multiplication of parties and fractions than in any deep seated revolt or demand for a new institutional basis of political action

THE CHALLENGE TO PARLIAMENTARISM

The political theorists of the nineteenth century seemed for the mos part to imagine that with the gradual extension of the franchise, th gradual perfecting of the parliamentary machine, and the gradual acquisition by nations new to responsible parliamentary government of experience in its use, the problem of political structure would be settled for goo and all. Few thinkers, however staunchly they uphold the parliamentar system, would now maintain that view in quite its old simplicity. It i increasingly recognised, even among believers in the "Sovereignty c Parliament," that a democratically elected Parliament can be, at bes only one vital expression of the consciousness of the community, that n political theory can afford to ignore the numerous forms of associati and institutional life of the community outside Parliament, and that th

st democratic parliamentary system may fail in the hour of trial be-
se it lacks driving force and does not provide the basis for a strong
vernment capable of guiding the community along creative lines of
elopment. The Victorians, indeed, were content with parliamentarism
tly because in accordance with their philosophy of *laissez-faire* they
ught of the countries of the world as deriving their creative momentum
from the State, but from the competitive endeavours of private enter-
se. The State was thought of rather as a policeman, or at most a referee,
n as a body designed effectively to control and organise the national
rt. Even, then, if Parliaments did appear to be lacking in initiative and
l-power, this did not seem greatly to matter ; for these qualities could
supplied apart from any direct activity on the part of the State.

his change of attitude towards Parliamentarism is due largely to a
nged idea of what States ought to be and do. The growth in the scale
economic enterprise, the development of what is called " Economic
perialism," and the pressure of the organised workers for social reforms
for a better distribution of wealth have radically altered the normal
k of the modern State, in both home and international affairs. States
now called upon not only to undertake a vast mass of social legisla-
, but also to an increasing extent to organise and control the economic
of Society. Rapidly changing conditions at home and abroad make
essary a constant recasting of the economic machine ; and the ever-
easing demand for overseas markets or for the loan of foreign capital
ses the State to intervene more and more in order to protect the
erests of its trading nationals, and twines economics and politics in-
icably together in the sphere of international relationships. Con-
uently, States and Governments are called upon to be more active
vigorous in the formation and pursuit of policies and plans of action ;
the careful checks and balances of the old parliamentary system are
as a severe and sometimes crippling restraint on swift or decisive
on.

here is a second reason still more fundamental for the contemporary
ay of parliamentary government. In Great Britain, at any rate, the
es dividing the two great parties during the Victorian era, while they
e for the most part clear enough, were relatively small, and rested on
ssured basis of agreement concerning the general structure of Society.
he United States the dividing issues were far less clear and even less
damental ; and the common basis of agreement was—and is—even
er. In neither country was any considerable party or group even try-
to change the structure of Society in any far-reaching way. Socialism
ted as a doctrine, but not as a party ; and there was no other challenge
he established order. Where, as in France or Italy, there was less
mon basis of agreement about the structure of Society, the parlia-
tary system worked far less smoothly and with less assurance.

o-day, in all the leading countries except the United States, conditions
radically changed. In the first place, the European countries have by
neans recovered from the upheavals of the War. There are new coun-
, such as Poland, Jugo-Slavia and Czecho-Slovakia, which have not
settled down to the idea of common nationhood, or learnt by experi-
the arts of administration. There are countries, like Germany, which

have undergone a political upheaval and are working a new political machine under difficulties made greater by continued foreign interference in their affairs. Italy and Russia, in their several ways, have thrown over parliamentarism, and are experimenting in new conceptions of government as well as with new machinery. France is still in a condition of War neurosis which makes prediction of its political future very difficult; and even Great Britain is finding her long-established parliamentary machine more and more inadequate to the growing complexity of her political and economic problems. Moreover, all the European States, except Russia, have superimposed upon themselves a new machine of international government in the League of Nations, and are experimenting with this new instrument under exceptional difficulties created by their own neurotic condition and by the unsettlement of the entire political and economic basis of European Society.

SOCIALISM VERSUS CAPITALISM

Underlying all these hesitations and experiments is the great question of Socialism *versus* Capitalism. Almost every State, except the United States of America, has now within its borders a powerful Socialist movement organised as a party and strong enough to count in the making and unmaking of Governments. And one State, the U.S.S.R., is definitely Socialist in structure and policy and stands wholly apart from the comity of capitalism, challenging the other nations with its objective demonstration of Socialism as a practical system as well as a theoretical creed. It is true that the Socialist Parties of other countries for the most part repudiate Communism, and work for a gradual conquest of political power, and a gradual establishment of Socialism by parliamentary means. But this cannot alter the fact that class distinctions, and a difference of class point of view, now provide the most fundamental dividing line in the politics of the European nations, or that their influence is strong enough to have destroyed once and for all the old community of fundamental assumptions among the contending political parties. Nor can it be denied that the existence of Russia, with its Five Years' Plan and its bold and challenging attempt to reorganise the entire life of that great country—agricultural as well as industrial—on Socialist lines, is bound to react powerfully on the politics of other countries.

Fascism, as we have seen, is above all an attempt to override class distinctions by making the ideas of Nationalism and the Corporative State the dominant note in contemporary politics. But I, for one, do no believe that this attempt can in the long run succeed. It might, in thi or that country, if in the modern world any one country could really isolate itself from the impact of world forces. But Socialism, as a movement based on the working-class, is a world-wide movement, bound t intrude itself into the internal affairs of every State. Italy may hold it of for a time by strong measures of dictatorship ; but even Italy cannot kee it permanently out unless it can succeed in truly reconciling the claim of Capital and Labour within the existing economic system. Americ may hold it off longer by continually broadening the basis of America capitalism through the wide diffusion of industrial ownership among th king-class ; but this policy depends on the maintenance of high and ng wage-rates and on America's ability to make use of her huge protive resources without an upset of economic equilibrium such as eatens her to-day. As long as the non-Socialist world can offer to its kers rising wages and reasonably steady employment it can probably d out for capitalism against its own Socialists at home, and the influe of Russia upon it. But can the non-Socialist world continue to en- these advantages ? They look none too secure to-day ; and I doubt ey can again be made secure.

, as I believe, the world is on the verge of a Socialist era, what form olitical organisation in the future likely to assume ? The political conersies of the twentieth century will turn, not on the nineteenth cen- issues of extension of the suffrage, vote by ballot, initiative referen- and recall, the powers, merits and demerits of Second Chambers, or onstitutional monarchies or republics, but rather on far more fundatal problems of the very structure of Society. The main question will not how we are to organise the machinery of government, but how re to organise the entire economic and political life of the community, of one community in relation to others. Politics and economics will e to be thought about as mainly separate problems, and will present nselves as one and the same problem.

his unity is, of course, common ground between Fascism and Comism, which alike challenge the old divisions which the parliamentary em has so far accepted as natural. Parliamentarism's chance of sur-, under the changed conditions, seems to me to depend on its power lapt itself to the new tasks which this unity of politics and economics ents. Parliaments, if they are to survive as sovereign, have to find s of bringing the economic life of the nations under their effective rol ; for this economic life is crying out for organisation—for national international planning—and if Parliaments resign this task into other ds they will, under modern conditions, be throwing away the subce of authority, and keeping only the shadow—and even that they not keep for long.

it Parliaments, as they exist to-day, are obviously incapable of organ- or controlling effectively the economic life of Society. They are too lating, too inexpert, too congested with a mass of secondary business, ke such a mighty task in hand. Either they must reform their ways; ey will be superseded by some more efficient instrument of control. do not mean, of course, that a Parliament, any more than a Soviet gress, can or should undertake directly the detailed control of indus- and services. Far from it. That form of Socialism is thoroughly out shion and never likely to be revived. Any system which attempts to rdinate and control the economic life of the community must be ed through a variety of functional organisations, to which large rs must be delegated in their several spheres. The central organs of rnment must, if they are to work even tolerably well, fling off all l and delegate all specific administrative tasks. If Parliaments anye can do this, and concentrate all their time and energy on the eme direction of policy, they may survive, and deserve to survive.

t can they ? I gravely doubt it ; for I doubt if the parliamentary method of election is really suitable to the new tasks of government Parliamentarism has worked only where it has been based firmly on party system, presenting the electorate with rival candidates offerin variants upon a broad community of policy and objective. It has worke because, and only because, there has been enough community of vie for an incoming Government neither to try, nor usually even to desire to undo the work of its predecessor. But in Europe, at any rate, it is impossible to rely on this basis for the future.

The business of Governments is to govern. Now government, in an real sense, will become impossible if successive Governments come spend most of their time in undoing their predecessors' work. Moreove if any party sets out really to change the fundamental basis of Societ it must feel assured of its own prolonged continuance in power, and agains the undoing of its work by the opposite party. But under the parliamentary system it can never have either of these assurances ; for both them are plain denials of the postulates of parliamentary democracy. find it impossible to believe that any country will ever achieve Socialis by parliamentary means, though parliamentary methods may avail carry it a certain distance along the road. For Socialism involves a radic change in the basis of Society, such as could not possibly be carrie through to the end piecemeal, or in face of all the checks and balances a neatly adjusted parliamentary system.

If, then, Socialism is to come, I believe it will involve transitional some form of dictatorship and, when that is over, a system of admini tration far more closely resembling Sovietism than parliamentarism. saying this I am postulating neither violent revolution as a means, n Communism on the Russian model as the instrument. Different countrie with widely different economic and social conditions, will need to wo out their own salvation each in its own way. What those ways will be c no more be prophesied to-day than the present system in Russia or Ita could have been prophesied before they were brought into being. Com munism, of course, did begin with a theory based on Marx ; but, whi this theory to a great extent supplied the driving-force of the movemen no study of Marxism would have enabled the student to predict the cour of the Russian Revolution or the subsequent history of the Soviet syste Fascism started almost without any theory at all, save the broad idea aggressive popular Nationalism, and tried to grow its theory along wi its propaganda, justifying what it found itself doing rather than doi what it conceived in advance to be just. This may be its weakness ; Fascism may prove to have no sufficient roots. But it remains true t living systems of Government grow : they are not made after a preco ceived pattern. It has, however, been demonstrated that they can gr very fast.

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MODERN THEORIES AND FORMS OF INTERNATIONAL ORGANISATION

By

C. DELISLE BURNS

SYNOPSIS

ern civilisation depends upon an elaborate organisation of inuous intercourse between all the peoples of the world. This nisation has three aspects — the economic, the cultural and the ical, and in each of these new theories follow from the understanding of the new situation. Economic organisation for supplies services is international in the banking and investment system, e great Combines such as those in the oil trade, in the armaments e, and in the normal organisations of commerce. But the theories is new aspect of life are somewhat ancient. In general Culture, nation depends for its science and its arts upon continuous course with other nations : but civilisation is still believed by y to be a local product. In political or governmental organisation, States of the world have been compelled to co-operate, largeiy use the modern State fulfils new functions in public health, ation, etc. The League of Nations is the best example of this peration. The principles involved would logically refute the old eption that " defence " is needed by every State against every t. But the League system operates within a complex of ancient utions, such as diplomacy, and ancient fears and suspicions. The amental problem therefore is how to create an " international l " in each nation.

MODERN THEORIES AND FORMS OF INTERNATIONAL ORGANISATION

Modern civilisation depends upon a close and continuous contac between men and women of distant countries, different languages an distinct traditions. The common man's food and clothing in any moder community is drawn from all parts of the world. We do not in Gre Britain adorn ourselves in woad and imbibe mead, as our forefathers di We wear cotton and silk; and we eat oranges and bananas. But th standard of life could not have been established, and it cannot be mai tained, without international commerce and international banking. Norm daily life is part of a social structure which is world-wide : every breakfas table and every drawing-room is international.

Most men think of civilisation in terms of food and clothing ; b under the surface of daily needs is the structure which makes the supp of those needs possible ; and that too involves continuous contact betwe men of different races and nations. The science, applied or speculativ which makes machinery possible and is always improving mechanism is kept alive by contact between men of genius in different nation Health gains upon disease by the use of such contacts. And if civilis life is understood to include some music, painting and poetry—the too are the results of many years of contact between the artists of differe traditions. The existing situation in any modern community, therefor requires an explanation in the form of a working hypothesis of inte national contacts ; and if modern civilisation is worth maintaining, requires a policy which arises out of the actual situation. The fac change more rapidly than the ideas of men with regard to the facts, ar still more rapidly than the policies by which men endeavour to contr their own fate, in view of such facts. Therefore the modern world difficult to see clearly and difficult to manipulate. Most men rea adolescence with the intelligence and imagination suitable only for chil hood. Most groups of men are traditionalist, in the sense that they belie it to be " practical " to practise the mistakes of their grandfathers. A in the endeavour to see things as they are, one of the chief difficulties that the instruments for seeing them—the words we use—are inherite The words " international," " State," " government " and even " co merce " do not always add to our understanding of contemporary hab and beliefs.

The characteristics of modern civilisation seem to be as follows. T sort of life which is lived in London and Glasgow, New York and Ottav Paris and Berlin, is the most recent result of the process of mechanisati and large-scale social organisation, called the industrial revolution, whi began about a century ago. But to-day a new revolution is occurri Population in modern communities, which had increased rapidly fi years ago, has now begun to decline. The expectation of life at birth er ; but the birth-rate has rapidly decreased. Hence in the modern d populations are of greater average maturity, more healthy and h more active intellectually and emotionally. Fewer children mean r dependents upon each family income : and therefore more money luxuries," more leisure for women and less exhausting labour for The modern world is very much richer, per head of population, than have ever been. Poverty still exists, obviously ; but that is due to istribution, not to lack of productive power. In general the standard fe has risen very greatly in modern communities. There is much public wealth, in the form of roads and parks and schools, and much leisure, with many more opportunities for enjoying leisure. Many people than ever before are deriving some advantage from modern ntions and the modern organisations of society.

his modern world however exists in the midst of older worlds, upon se services the modern world depends. The oil-seeds for soap and rubber for motor-cars come from the labour of primitive peoples. cotton, corn and meat come from the labour of peoples who still under mediæval conditions in Asia. We in the modern world in ppe and America are the beneficiaries ; and it is suspected that those rs are often the victims of a civilisation over which they have no rol, even if they pick up some scraps of advantage from maintaining standard of life in London, Paris and New York. The " scale " of nisation upon which that standard of life depends is world-wide ; the effect of improving that standard is to increase the contacts een parts of the world in the tropics, for example, which have so far ined primitive and other parts of the world in which men use cal products.

obsessed are we with the economics which enraptured our grand-rs, that even to name commodities seems to involve discussion of omic exchange. But oil-seeds, rubber, cotton and wheat are forms rvice ; and service of one man by another is largely a psychological Even if the Londoner who uses soap is not aware of the labour of African who gathered the palm kernels from which the soap is made e relation is psychological, " in the unconscious." Cut off the supply oap, or of railway-trains, and the man who never noticed whose ur he used is at once offended at such action " against the com-ity." But normally men have not thinking-power to spare for every-habits. The relations of man to man are mainly unconscious ; and their desires and their energies is built the exchange-value which been so elaborately studied. But men are now related, in all parts of world, for the maintenance of that civilised life or that share of it h is psychologically dominant in the conceptions of what makes life h living.

ECONOMIC INTERNATIONAL ORGANISATION

the effort to secure the supply of soap and motor-cars, modern sation has produced institutions for the organisation of transport exchange. Among these, the institutions *within* the modern world ncreasingly parts of a single system. The banks of London, New

York, Paris and Berlin work together. But further, in the same effort t secure supplies for a rising standard of life, the modern world i “ modernising ” the primitive tropics and mediæval Asia, which still li outside what is called “ modern.” The bicycle is to be found in Afric and the radio-set in China and India. Thus in spite of a distinctio between modern civilisation in the present world and outlying remnant of earlier types of social life, all the peoples and races of the world ar united. This is new. The first traces of such unity occurred about fift years ago; but the present form of the social structure in the whol world is hardly yet twenty years old. The recent increase in productiv power, both agricultural and industrial, the increase in the hours leisure and in the number of ways of using leisure (cinema, radio, etc. the psychological reactions against alien influence, the desire of soci classes hitherto impoverished to share more of the benefits of civilisatio the recent creation of new States, more rapid transport and means communication—all these factors are operative to-day in the tendenc towards economic organisation across frontiers and racial barriers.

Finance is organised internationally. The central banks of the mo important centres of financial operation are directly organised in relatio to the new Bank for International Settlements. Under the Young Plan fo German Reparations, the Bank for International Settlements was set u in 1930. This is partly an institution for organising the payment Reparations, and in that aspect is of no permanent importance; bu evidently those in control of policy intended that the B.I.S. should als be a first essay in organising credit on an international scale. It is a ver recent attempt; but it is only the latest phase of a movement which ha been, since 1918, rapidly increasing the contacts between the centr banks. Apart however from central banks, the ordinary banks in a commercial countries have been either founding branches in foreig countries or entering into special agreements with foreign banks.[1] Th is inevitable, because payment is made in different currencies in differe countries. But international organisation of finance is even more impor ant in investment. The “ export of capital,” outside any frontier in foreign countries, has increased.[2] Thousands of British citizens, f example, hold investments in companies which operate in the Dut East Indies or in South America. And in any one such company the may be shareholders of ten or twelve different nations. Where the com pany is controlled by nationals of one State and operates in the territo of another, the controllers sometimes use and sometimes are used their Government. This flow and settlement of capital in differe countries therefore causes, first, an international organisation for t maintenance of the enterprise and, incidentally, some government policies which affect more than one State. Much of the existing syste however, is already more than fifty years old and, therefore, hard modern. What is modern is the international structure of the banki system and the very rapid extension of the export of capital. Both the factors in modern life are making political frontiers less important.

The recent export of capital is largely due to the industrial changes

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[1] See C. Delisle Burns, *International Politics* (1920), pp. 96 sq.
[2] See C. K. Hobson, *Export of Capital* (1915).

past ten years. The collapse of German currency after the War led
hunger for industrial capital there ; and much was brought in from
erica and elsewhere. But that was an abnormality. More significant
ne entry of American capital into the British and French motor-trades.
is is a new phase of the movement which led to the entry of British
German capital into the United States before the War of 1914–1918 ;
now several industries are so organised internationally that one or
er national group has control of supplies in most countries. Thus
nch-factories under American control exist in Europe and elsewhere
the manufacture of agricultural machinery, telephones, sewing-
chines, cash registers, shoe-machinery, etc. A large part of the
on industry in the whole world is controlled by British capital-owners ;
he chemical industry by Germans ; of the glass industry by Belgians ;
he perfume industry by Frenchmen ; of the margarine trade by
chmen ; and of the match trade by Swedes. That one trade is con-
led internationally by the nationals of one State does not prevent its
ng of advantage to the nationals of the other States within whose
tiers it is carried on ; but obviously, whatever advantage accrues to
a trade from the tariffs of a State is an asset to capital-owners who
outside that State. Indeed, tariff-walls have in some cases provided
opportunity for foreign capital-owners to invest inside the walls.
control of production-policy then remains outside the tariff area.
example, electricity production in Canada is largely dependent upon
tal controlled in the United States.

lso within the past ten years and as part of what is called rationalisa-
, agreements, cartels, trusts and combines have tended to unite
strial enterprises of different nations. Within any one State a cartel
rust may " rationalise " an industry by closing down obsolete plant
ne area—thus causing unemployment there—in order to work more
with plant in another area. The same movement internationally
close down plant in one State in order to produce better in another
e. The result upon public funds may be imagined. Again, certain
ortant supplies as, for example, oil, are controlled by a few great
rnational combines, more powerful than many small States. The
ng-policy of the Standard Oil Companies or of the Shell-Royal
ch Company is international in the sense that it affects directly the
ples of many different nations. And into this economic world of
rnational forces has entered, since 1920, the Government of Soviet
sia acting as a trader in oil in all countries, under the name of the
.P. Enough has been noted, then, to indicate the conclusion that
omic forces are organised internationally and, even when controlled
ne national group, operate upon all others. The States of the world,
ever, are still rivals rather than co-operators, partly because of the
of war but partly because the ancient conceptions still prevail with
rd to the effect of State-policy on commerce.

ommerce is organised internationally, in the sense that raw materials
one country are needed for manufacture in another, or because
-stuffs in one area are consumed elsewhere. Shipping, as the instru-
of these necessities, is also an international service. Commerce
s frontiers has increased since 1913, in spite of the fact that 7,000

miles of tariff-walls have been erected in Europe since the Armistice of 1918. The higher standard of life desired in the modern world, makes it necessary to secure supplies from all countries to be used in each country.

In economic services which are internationally organised for the advantage of consumers, and therefore for the raising of the standard of life everywhere, the Co-operative Wholesale Societies are among the most significant institutions of the modern world. Thus the English and Scottish C.W.S. supply the Russian Co-operative "Centrosoyus" with most of the tea consumed within the jurisdiction of the Soviet Government. An open credit of about a quarter of a million pounds sterling marks the extent of the trade. The relations between the Consumers' Co-operative Societies of about thirty different countries are organised through the International Co-operative Alliance, established in 1895. Since 1918 many Congresses of the Alliance have been held; and direct trade between organisations of consumers is thus promoted.

The importance of this in international organisation does not rest upon the mere extent of the trade. Even the increase of trade by the Co-operatives is small by comparison with the vast amount of banking business, of foreign investment and of commerce upon the old plan. But the acquisition of one new habit is more significant of character than the continuance of many old habits; and therefore perhaps, from the evidence, one may expect an increasing attention to means for raising the standard of life of the consumer in all countries. Since the chief international economic problem of the immediate future is the increase of the markets to take up the increase of productive power in all countries, consumption is more important for policy than production. We know how to produce but not how to consume. With a skilled organisation of consumers' habits, however, the standard of life of the majority could be rapidly raised.

Outside the sphere of normal production, but closely affecting the economic policy and also the political relations of Governments, is one "trade" with important international characteristics—the trade in armaments. The private firms which manufacture armaments supply partly the State of which the capital-owners of the firm are nationals but partly also the Governments of other States. Those States, such as Greece or Brazil, which have not their own State-factories for armaments buy in the open market from Vickers, Schneider's, the Skoda Works o the Bethlem Steel Works. The Great Powers, Great Britain, France and the United States, have within their jurisdiction the most powerfu firms which supply the smaller States. Agents of the private armamen firms travel to all the minor capitals and advertise the latest warship and bombing aeroplanes.[1] If one State buys a powerful type of bombin aeroplane, it is easier to persuade its neighbours to buy a similar type for the armament firms supply "defence" against the instruments o defence, which they also supply. Thus the organisation of "defence by modern States necessitates a trade which derives gain from fear o

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[1] See the pre-War study of this in G. H. Perris, *The War Traders* (1914) and a post-War study, *Die blutige Internationale der Rüstungsindustrie*, by Lehmann-Rüssbuldt (1929).

:ack. The more nervous the peoples become, the better the profits on naments. This seems to have been regarded as a danger to international ity; for in the Covenant of the League of Nations it was laid down at the League should " advise " how such evils can be prevented as se from the trade in arms; but so powerful are the interests involved at the League has never attempted the task.[1] International organisation selling the instruments of destruction to Governments has developed ice " the war to end war ": but international organisation for the ntrol of the traffic in arms has proved utterly impossible. The chief rchasers of arms are the Governments of the modern world, which esumably, in so purchasing, act in accordance with the desires of their izens and subjects. Thus the State itself seems to some to be the chief stacle to the improvement in the standard of life which is implied as purpose of modern civilisation.

Viewed as one whole, the organisation of production and of consumers' pplies in the modern world involves co-operation between men and men of many different States, races, religions and languages. Most dern products, such as a shoe, a gramophone or a cake of soap, involve nplex organisations for finance, commerce and manufacture. Any one de—for example, that in wheat or in motors—is an economic unit thin which State-frontiers and language-barriers are not of much portance. The ordinary household in any modern country is the result international intercourse and international exchange. And in spite of nomic nationalism since 1918 and the setting up of new industries in countries, the dependence of common life in each country upon all ers daily increases. While in each locality some are attempting to pply all the necessaries of their neighbours, these very neighbours are quiring tastes and habits of using leisure which reduce the proportion income spent upon necessaries and increase the proportion spent on non-necessaries, for which they depend upon all parts of the world. e more the standard of life rises, the greater the use of the international anisation of supplies.

THE THEORY OF ECONOMIC INTERNATIONALISM

The organisation of supplies in each country, however, is still limited the obsolete conception of a local market " protected " against foreign ers of the goods required for civilised life. Almost all Governments d to act as agents for local producers who have influence in the political bies. On the other hand, a few countries maintain, with regard to st commodities, what is called " Free " Trade—that is to say, the organised scramble for selling in any market at the price that will lercut competitors. It is felt by some that if a nation or a group of men oes to the wall " and loses its occupations, and therefore its purchasing ver, because of the differential advantage in production of some other ion or group, it may be good for the rest of the world. But it is bad for victims of the " play " of supply and demand. Thus, the need for rnational economic organisation is obvious; for supplies are inter- ional and no nation ought to suffer. But, at the moment, there are no new policies concerning the international organisation of commerce. We stand irresolute between two obsolete policies—one that of " walls " round a local market ; the other, a scramble in which distress takes the hindmost. Meantime, productive power increases so fast that, even if a wall kept out all foreign products from a country, that country would not provide a large enough market for its producers ; and on the other hand, even if all tariffs were abolished, although some markets would be extended, the purchasing-power of the majority would not be adequate to buy all that is produced. The international economic problem of to-day is not to be read in terms of frontiers and " national " trade, but in terms of the distribution of purchasing-power in all nations.

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[1] See the Covenant, Article VIII., Section 5.

One might imagine that, as the new productive power requires larger markets, the policy of any one Government would promote the increase of the purchasing-power not only of its own citizens but of the citizens of other States. Instead of that, however, each Government is dominated by small groups who still believe that to reduce the foreigner's purchasing-power is the best way of increasing their own. In the same way, in the days of slavery, the slaves having no purchasing-power, the markets were not great enough ; and the slave-owners thought they could improve their position by reducing more men and women to slavery. And yet, quite apart from humane sentiments, Africans are far more useful to us if they can buy cotton-goods and gramophones than they were as slaves of Europeans in the tropics. Perhaps an international policy may be adopted by some Government in the future ; but so far nothing has happened except Commercial Treaties on the pre-War plan—" pull-devil, pull-baker "—and the most excellent rhetoric at Geneva. The economic policy of Governments is like their disarmament policy : it is based upon the maxim that " the other fellow must begin."

This, however, is not strange ; because even the facts upon which policy might be based are obscured by the information collected upon the old assumptions. Thus statistics of import and export for each country—useful for the purpose of taxation—maintain the obsolete myth that a " nation " is a trading unit. Differences of currency obscure the exchange of goods, necessary for any modern production. A peculiar arithmetic provides us with a subtraction sum to show a " balance " of trade, according to which it is made to seem that " we " gain if " we " buy less from " foreigners." British apples are distinguished, not from British boots, but from French apples : and thus the relation between apples and boots, in the standard of life, is obscured. And how could we control epidemic disease if we distinguished, not smallpox from cholera, but French bacteria from British bacteria ? The prevailing conceptions of the economics of commerce are too primitive for the establishment of a modern policy. It is impossible to have international economic organisation for the public advantage, until economic conceptions are international, or at least until they exclude irrelevant factors in the system of production and consumption.

Thus, on the one hand, there are international Cartels and Trusts and an international export of capital, which may incidentally be advantageous to the general public, but are aimed not so much at their advantage as at the gain of the owners of capital in the enterprises concerned ; we have

ernational economic organisation, not as a public service but as a means
greater private gain. On the other hand, the States of the world, each
which presumably is a system of public service for its own citizens or
jects, act as obstacles to the advancement of public advantage outside
ir own borders, in so far as each Government can be used to injure
trade or industry of foreigners. Thus the States, which might organise
co-operation in economic policy, a force capable of directing economic
anisations for public advantage, are prevented from adopting such an
nomic policy by obsolete ideas. The State-system has not developed
far as the economic system of finance and commerce. The absence of a
dern State-system, the survival of State-anarchy, stands in contrast to
modern system of economic organisation which overrides frontiers.

odern theory, based upon the review of facts, indicates the probable
olescence in the near future of the territorial State, at any rate in its
nomic functions. Already the figures for trade and production are
ng collected by the Secretariat of the League of Nations to show,
“ Great Britain ” and “ France,” but cereals, rubber and motor-cars
the whole world. The balance of production and prices as between
icultural and manufactured products is already recognised to be more
portant than the balance of imports and exports for any country. But
most important factor in the formation of a modern theory of inter-
ional economic life is the contrast between producing-power and
suming-power. Obviously the new industrial revolution, which has
sed idleness in agricultural countries and unemployment in industrial
ntries, is only in its first phase. Power to consume has not kept pace
h power to produce. International organisations therefore may adopt
of two policies—either they may restrict production to maintain
ces in a shrinking market, or they may take steps to extend the markets.
the former policy, at the moment, we have examples in the effort to
ch international agreement for restricting the production of rubber
tin. This is merely the international version of the policy of holding
prices, as was attempted by the Brazilian Government in storing coffee,
Egyptian Government in holding stocks of cotton, and the United
tes Government in holding stocks of wheat. It may be possible to
vent the fall of prices at some level ; but no one knows at what level
rther fall can be stopped, because substitution of commodities has
ome much easier in modern civilisation. For example, when Germany
ing the War was cut off from supplies of Chilean nitrates, the German
mists drew nitrogen from the air for explosives and fertilisers. It is
sible that restriction of production may cause substitution of new
ducts. However, in any case, international agreement for restricting
duction is difficult to organise without control by a monopolistic
rnational Trust.

n the other hand, the policy of extending the markets to take up the
ease of production seems to be more hopeful so long as there are, in
part of the world, men, women and children with a very low standard
fe. The greater part of the human race, which is in Asia, is still unable
urchase modern products and therefore still not a “ market.” Even in
ope and America, within the modern world, poverty is common.
t is to say, there are millions who need more food, clothing and

leisure occupations. It is irrelevant that they are Chinese or Indians or Germans, just as it is irrelevant that the food they need may come from tropical Africa or from Canada. Again, it is irrelevant that they may buy gramophones from England, since the materials that go to the making of gramophones come from all countries. The point is that economic progress depends upon international organisation for the increase of markets in all countries, that is to say internationally. It " pays " a great international Cartel to have more purchasing-power, and therefore richer people, in French West Africa, for example, although the French State may attempt to prevent the sale of non-French products there. In such a conflict of " powers "—the economic and the political—the State will prove the weaker. Thus the international need for new markets may support the advance of credit to peoples now unable to purchase ; it may cheapen production still further ; and it may increase the amount of leisure available in the whole world, because men spend more in leisure. Just as tea was once a luxury for a few and is now, in the modern world, available for many, so leisure, which used to be regarded as the privilege of a small caste, may be an economic necessity for the new production and therefore available for all men. But if that sort of policy is adopted, the international organisation of supplies will be a public service. It may even come to be recognised, not as a rhetorical phrase at the end of a chairman's speech, but as a principle of economic policy, that production is mainly a service of the consumer and only by accident, as it were, a source of income for the producer. The importance, even in economic theory, of potential, as contrasted with effective, demand will then be understood. A price-policy will then be influenced, not mainly by the costs of production but by the existence of *potential* markets, demanding credit because they are not *actual* markets.

Again, as the amount of leisure increases and population decreases, tastes will become more varied and less stable. Thus policy will envisage not merely an extension of the markets for " standard " products, such as cotton-clothing or wheat, but the creation of markets for products which never existed before, for example aeroplanes and radio-sets. Ten years ago there was no market in radio-sets ; at the moment there is no market in television-sets. But invention, advertisement and new tastes, due to better education, create markets where there were none. The rivalry of the future may be, not between producers of the same products scrambling for the scraps of a shrinking market in traditional goods, but between producers of different kinds of products. But because in non-necessaries taste is changeable and no market is " safe," therefore makers of non-essential new products will always look outside the frontiers of their own State, or outside the barriers of their own tradition, to find alternative markets. This will inevitably lead to increase of international commerce ; for even if every locality grows its own food, no one locality can be trusted to continue to absorb a supply of non-essentials. And besides, the more " modern " the product, the more varied must be the sources of the material necessary for making it. The increase of gramophones involves an increase in the demand for screws and other parts. Thus modern international organisation of economic life will inevitably disregard frontiers.

It cannot be said, however, that such conceptions are prevalent. They not even discussed in the existing international institutions for nnecting economic groups of one nation with those of another, in estions of policy. For example, the International Chamber of Comerce holds meetings at which the commercial men of different national oups may discuss their common interests. The Chamber has made ent pronouncements against war and against obstacles to trade; but viously these do not represent the views of the armament firms, for mple, or of the manufacturers protected by tariffs. The International deration of Trade Unions continues, as before the War of 1914–1918; t its meetings are held in an atmosphere rendered stormy by rival oups organised under the patronage of the Moscow Government. ade Unions in certain trades (e.g. Textiles and Mines) also have their ernational associations; and in such groupings as the International sociation of Rotary Clubs there is a vague tendency for men of goodwill different nations—to dine together! But although all such Associations d Groups provide platforms for new conceptions, no such new concepns have come from them.

CULTURAL INTERNATIONALISM

The standard of life, that is to say, the way of living in modern civilison, is dependent not only upon supplies of goods and services but upon minant conceptions of the way in which to *use* such supplies. That is to , the standard is fundamentally "moral" or cultural. It is the result of ideal, an emotional conception of what is worth while, which is "in the ." Thus the way in which men live in London, Paris or New York is a aviour-pattern expressive of desires, many of which are hardly scious; but the whole complex of customs is the typical culture of dern times. In the modern world we have not merely public drainage, also particular forms of food, clothing and entertainment. There is sic also, largely of the eighteenth century, and some painting, which be called modern, outside the public picture-galleries. The arts are nificant of the culture of any age; but for most men, as in the ninenth century, science is more significant of the modern world than the ; and science is obviously the result of an interchange of ideas between n of genius, who belong to different nations. In general, it may be umed that the whole of that "culture" which underlies the supply of nmodities and directs its use is international; for both the sciences and arts depend upon the maintenance and development of an interchange deas across the frontiers of States and over the barriers of language or erse traditions.

n earlier times the contact of minds, across such barriers within the opean tradition, was very largely in the field of the religious consciouss. The Roman Church assisted in civilising the European tribes of the k Ages: Luther and Calvin at a later date influenced men of other ions. Similarly, outside the European tradition, Buddhism spread into na and Japan; and Islam connected the Arabs, the Turks, the sians and the Moors. But in the modern world the significant contacts oss the barriers named above are not religious; they are in the field of the sciences and the arts. Modern mathematics is international, even in its language. Modern physics and chemistry are international. Modern medicine is almost international, in its store of knowledge, if not in its practice. Similarly in the fine arts, architecture of steel and concrete in each modern country is affected by the comparison of experiments in all modern countries. The discussion of the actual sciences and arts of to-day, however, occurs elsewhere in this book. The point for attention here is that some form of social organisation is implied in the activity of modern scientists and artists : and that form is international. Scientific societies promote international contacts. Exhibitions of the work of foreign artists have become the familiar custom in all great capitals. And the increase of all this interchange within the past ten years has been remarkable, though the new habit is by no means securely established.

In the larger sphere of education, from the nursery to the University—not, after all, a far journey—there is a rapid increase of contacts across frontiers. Visits of school-children to foreign countries are much commoner than they ever have been before. The new educational uses of gramophones, cinemas and radio spread a knowledge of other village-pumps besides our own. Language-teaching is becoming more genuinely a study of a foreign or a national mind, and less a collection of tricks, the performance of which, if it were attempted outside the school, would astonish both one's fellow-citizens and the foreigners, whose language such tricks are supposed to exhibit. Even history, the most traditionalist of all the instruments of education, now begins to recognise that there is a modern world of contacts between peoples. School-methods have been revolutionised, and there is a growing interchange of scholars and teachers across the frontiers of States. Thus the organisation of education tends increasingly to be international.[1] But there is a long way to go before the mental attitudes and assumptions of men are consonant with their daily practice in eating foreign foods and wearing the products o foreign labour. National prejudices are so deeply imbedded in men's minds, that many years of education may be necessary before men are aware of the characteristics of the modern world in which they live.

For the supply of news from foreign nations a few great news Agencie exist, closely connected with Governments and, in one case, the “ Tass ” of Moscow, an instrument of a single Government. Reuter, Wolf and Havas, organised from London, Berlin and Paris respectively, supply most of the material out of which “ the public opinion ” of one nation builds its beliefs about other nations. The Agencies have representative in many countries, who receive “ news ” from official sources or collec news elsewhere. In some cases the representative is either a mino official in an Embassy or even an agent for selling goods, armament among others. Wealthy newspapers in some places maintain their own correspondents, who have similar connections or similar plural functions But the greater part of the “ news ” which connects one nation wit another comes through the chief telegraphic Agencies, which supply th

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[1] The Committee of the League of Nations which deals with “ Intellectua Co-operation ” is a sign of this tendency, but hardly more than a wave upo the vast current, which follows its course untouched by the wave. The Com mittee may, after the reorganisation in 1930, do more.

ess generally. Whatever dangers there may be in the use of this or-
nisation, clearly the modern world could not exist without such an
borate structure of information and current comment from diverse
irces.

Let us suppose that the organisation of cultural contacts across the
rriers of race, nationality or language were effectual, what then would
the result upon the moral standards operative in modern life?
early the first result would be to delocalise the mind of the educated
in; but that would not imply an uprooting of the mind from its native
l. To be delocalised is not to be *déraciné*. Cosmopolitanism is only a
mitive form of internationalism. A man who has no country of his own
almost as bad as one who is completely absorbed by his own country,
d there is no contradiction between going on travels and having a home
start from, to which a return may be made. The intelligent contact,
erefore, between the French and the English, for example, does not
ke the French less French or the English less English, although it
es make each less primitive. In short, the modern conception and the
dern practice of civilised life involve the recognition that national
tures are distinct, but that each nation can develop higher *stages* in its
n national or racial culture. Thus there may be a French tradition of
ture and different *stages* within the history of that culture, distinguish-
French mediævalism from the French enlightenment and that again
m French modernity.[1] A civilised Englishman is not less an English-
n because he does not drink as an Anglo-Saxon would. A civilised
inese need not enslave his wife, nor keep concubines, in order to be
inese. But the contact between nations is the best means for develop-
what is best in each. As in the conversation between individuals,
h develops his own individuality by deriving something from the
er, so in the contact between nations, each becomes more civilised
what it derives from trade or from the exchange of ideas with the
er.

The cultural standard of the modern world is increasingly the result
contact between different traditions. Thus, for example, the use
soap made from palm-oil tends to spread into all countries; and an
reciation of Chinese art is increasing in the West. But neither wash-
nor painting destroys the roots out of which each man and each group
men grow; and the character of the tree in each centre of civilisation
be known from its fruit, not from the label that the political gardener
ches to it. The best fruit of each tradition is the result of free contact
ween all traditions; and the modern organisation of interchanges in
ure is therefore like an irrigation-plan which transforms primitive
ges into flourishing cities. The difficulty in appreciating the actual
ation in the modern world is that we tend to imagine that we are at the
of a process, whereas we are at its beginning. Civilised life is still a
experiment, only partially successful. Men cry out that "demo-
y" has failed, when it has not been tried; or that "education" is
ted, when we have hardly begun to discover how to teach or how to
n. History, which is now excavating a past hitherto unknown, is show-
how far we have come, without indicating how far we still have to go.

his theme is worked out in my book, *Modern Civilisation on Trial* (1931).

But in the modern world, the future is beginning to take its due place in thought. The England and France of 1950 will not be the England and France of 1850, nor even of 1930. The relations between the drama, the painting, the music and the common life of different peoples are already quite transformed from what they were a century ago. It follows that, if we so desire, we can transform the atavistic prejudices which divide and destroy into emotional ideals which may create a new civilisation ; but this new civilisation, among each people, will contain contributions of service and insight from all peoples. Thus the culture of modern times is necessarily international in its finest flower, although it remains national or racial in its " roots " in every land.

POLITICAL ORGANISATION

The organisation of law and order and of such liberty as we can achieve under a system of law—all this is what is called *the State*. There are now about fifty States, independent and autonomous, and many more institutions, to which the same name is applied, which are not in the same sense autonomous in all their functions. The history of political organisation is complex, and it is enough to note that, at present, the States of the world are conceived to include all men among their members and to divide the earth into separate jurisdictions. In some cases, as in Abyssinia or Persia, the State includes a great number of persons passively subject to the command of a few, as indeed is the case in most of the area covered by the State called Great Britain, or the British Empire, which includes African and Indian races, in no sense " citizens " but merely " subjects " submissive to rule. Citizens are persons having some share, however theoretical, in the power which is exercised by the Government. But citizens or subjects in all the States of the world are also producers and consumers, and they are affected by the fine arts or by such useful arts as cooking and washing clothes. Therefore in the modern world economic and cultural contacts inevitably support political contacts across the frontiers of States. Thus the States of the world make up a State-system and a Government in the modern world is inevitably in contact with other Governments.

The functions of the State have greatly changed within the past fifty years. Until about 1870 the State was chiefly a system for maintaining law and order, by the enforcement of regulations in a given territory through State-forces, and the exclusion from that territory of any other power by means of armed men. The chief contacts between Governments were those of war, the threat of war or the preparation for new wars The historians of war have recently become apologetic ; but until abou the middle of the last century both historians and their pupils, the politicians or statesmen, thought of war as the source of a peculiar commodity called " glory." This faded into " prestige " in the industrial era ; and the armed forces of States were regarded in " advanced " countries a agents for the sale of goods by the advertisement they provided for the nation whose " prestige " they maintained. In the modern world, however, since the armistice of 1918, it has become popular to say that arme forces are for " defence." The strange results of that form of mytholog be discussed later. Here it is enough to note that the States of the ld still remain armed bands " in the posture of gladiators," and that preparation in view of the possibility of future war obstructs the rgies which might otherwise be devoted to the improvement of health knowledge. Only a certain amount of ability is available in every eration ; and men in the service of the States of the world still spend eat part of the available ability in destroying or planning to destroy ability of other men.

hese same States, however, now perform functions with regard to istrial organisation, health and education which were never connected government until about fifty years ago. The new functions of the es called France, Great Britain and Germany, for example, are exsed in factory laws, in the organisation of preventive medicine and ne school-system. These functions, and not the exercise of force, are significant characteristics of the modern State. But in such functions es are not opposed, one to the other : indeed, owing to the increase of act in trade, the States have been compelled to co-operate. Hence modern State-system, which is to be seen in the immense number of mercial treaties, in the inter-State organisation for the control of emic disease, the improvement of communications and the rest. In- a modern State cannot fulfil its functions, even for the sake of its citizens, without co-operating with other States ; and the adminisve offices for commerce, industry, transport, finance, health and ation in each modern State act in co-operation with similar offices her States. The Universal Postal Union is one of the best examples of results of this co-operation, because in that Union each State carries rs for the citizens of other States. The art of government, therefore, ss and less concerned with " defence," and more and more coned with international organisation ; and in so far as government ines the organisation of public health, for example, the system of govnent in any country is a positive advantage for the citizens of all r countries. The practice of government in the modern world is being nationalised.

THE LEAGUE OF NATIONS

ne most significant result of this tendency is the League of Nations.[1] League is a system of co-operation under a Treaty, called the nant, between about fifty Governments. The system operates igh a Council, acting as a sort of Executive, an Assembly, and a anent Secretariat, whose office is at Geneva. The Council consists presentatives of five Great Powers, with permanent seats on the ncil, and nine others elected by the Assembly from time to time to sent the other members of the League. The Council meets three or times a year, usually at Geneva : the Assembly meets once a year,

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ee especially *Ten Years of World Co-operation*, an account issued officially the Secretariat of the League in 1930. Also C. Howard-Ellis, *The Origin, ture and Working of the League of Nations* (1929). The League of Nations n issues popular summaries in Great Britain and the League of Nations Partisan Association in the United States.

early in September, at Geneva. The League has now been in existence since January 1920, when the Covenant came into force. During that time it has performed some very useful tasks in the liquidation of difficulties resulting from the Great War.[1] League Commissions restored about 400,000 prisoners of war to their homes, thus giving happiness to common folk who had suffered from the quarrels of Governments even after peace was made. League Commissions fought and overcame the plague of typhus which was spreading westward from Russia and Poland, soon after the armistice of 1918, thus saving from disease and death Western people who perhaps are not yet aware of what they owe to the League The League also provided funds and organisation for the settlement o Greek refugees from Asia Minor in Greece ; it guaranteed and administered loans for the restoration of the finances of Austria and Hungary and it overcame some of the transport difficulties in Europe, which had been left by the Great War. The settlement of certain controversies between Governments was also achieved through the League, as, for example, in the case of the controversy as to Upper Silesia, between Germany and Poland, and the controversy as to Mosul, between Turkey and Great Britain.[2] In some cases warlike action, which would otherwise have caused open war, was stopped by the League, as in the dispute between Bulgaria and Greece in October 1925. The normal method of settling disputes which arise out of political or racial rivalries has been conciliation through, or in, the Council of the League ; but other disputes i reference to " rights " which arise out of Treaties, have been settled b the use of the Permanent Court of International Justice, which was se up in connection with the League in 1920. By May 1930, forty-two State had ratified the Treaty, accepting the jurisdiction of the Court, an twenty-nine had signed the so-called " Optional Clause." This Clause c the Statute of the Court is " optional " because it need not be accepted b all those States which use the Court ; but it makes " compulsory " on th part of its signatories the use of the Court for a certain limited number c cases—such, for example, as cases of dispute arising out of the terms of Treaty.

The whole of the League system now in operation, therefore, is tentative and, in a sense, experimental. We are in a new world. The relation of Governments are not what they were in the days of Napoleon c Gladstone ; a new machinery and new methods are being tested. The success which so far has been achieved in most of the tasks undertaken b the League is not less important because in certain cases, for example, i the Russo-Finnish dispute about Carelia, the League has failed to secur a solution. Only those who do not understand the art of government ca expect that the inherited rivalries and suspicions of the world could possibly be abolished in ten or twenty years. The actual work, however already done by the League shows that some of the dangers arising ou of national rivalries can be avoided.

The new system is not only a security against the repetition of ol

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[1] A fuller account is to be found in my book : 1918–1928 : *A Short Histor of the World* (1928).

[2] See a full account, with text of telegrams, in Sir E. Drummond (ed.) : *T Years of World Co-operation*, p. 31 (1930).

. It is also the basis for a progressive co-operation between Govern-
ts in the pursuit of interests common to all peoples. For example, it
nerally admitted that security from epidemic disease is an advantage
ll. The League Health Section therefore carries forward the work
n before the War by the International Office of Public Health. In-
ation about epidemics, the fixing of standards for sera and drugs,
other international tasks have been performed through the League ;
n these spheres of the art of government even States such as Russia
he United States, which are not members of the League, have found
nvenient to co-operate. Similarly, co-operation through the League
nade it possible to limit the international trade in dangerous drugs
n prostitution. New functions of government have been undertaken
e League system, as in the supervision of the government of the Free
of Danzig, and the League government, during a period of years, of
aar Territory. These, however, are results of the War of 1914–1918.
important are the new principles implied in the protection of
rities and the supervision of certain "colonial" territories called
dates. The Council of the League receives petitions from represen-
es of racial and religious Minorities, if the State, in which these
rities live, is bound by Treaty or Declaration to grant them certain
s. And in the case of some territories hitherto under Turkish and
nan rule, outside Europe, the Mandates Commission of the League
ves annual reports and advises the Council on the situation. By this
s, the territories divided among themselves by the victors of 1918
been treated as "Trusts," for the government of which the State
olling the territory is responsible before an international com-
ty, represented by the League. The system has made it possible for
laints to be made against, for example, the French Government with
d to Syria, the South African Government with regard to South-
Africa, and the British Government with regard to Palestine. The
lates Commission, reporting to the Council, is thus a new organ of
nment in international affairs, affecting the relations between
pean and some non-European peoples.

other section of the League system is the International Labour
nisation. The members of the Organisation are, in general, the same
e members of the League, although any State can belong to the
ur Organisation without being a member of the League. The I.L.O.
stablished under Part XIII of the Versailles Treaty and similar
of other peace Treaties. It exists for the promotion of industrial and
progress, in the elimination of inhumane conditions of labour. Its
al Conference, which meets annually at Geneva, and its Governing
consists of representatives, not only of Governments, but also of
nployers' and the workers' organisations of the countries which are
ers. Its permanent Secretariat, international in the same sense as
League Secretariat, forms the International Labour Office at
va. The General Conference discusses and, if possible, agrees to
ntions forming what is sometimes called International Labour
ation : but these Conventions do not bind the countries concerned
they are afterwards separately ratified. Several Conventions have
atified since October 1919, when the first General Conference was

held in Washington : and the result of the Conventions ratified, as wel as of the influence of the International Labour Organisation in general has been to “ level up ” the conditions of labour in certain backwar countries. New conceptions of international agreement with regard, fo example, to the uses of leisure, the housing of workers, unemployment an emigration, are being gradually worked out, by means of the informatio collected and published by the International Labour Office ; but th economic depression during the life of the I.L.O. has been so great, tha its full influence has not yet been realised.

The principles implied in the new system may now be discussed Although there was some experience of co-operation between Governments before 1918 in limited fields, there has never before been experience of dealing with major political issues by periodical Conference between Governments organised through an established internationa Secretariat. The League now acts through an Assembly, a Council an a permanent international Secretariat, all of which imply an entirely ne principle of co-operation between States instead of rivalry and “ defence.

The system of co-operation between Governments includes tw distinguishable methods—conciliation with reference to issues out which disputes or conflicts may arise, and common action when particular line of action is agreed to be to the common advantage. Unde the general heading “ conciliation ” may be included the work of th Council, chiefly under Article XI. of the Covenant, for the adjustment conflicting interests, and the work of the Court of International Justic in the rendering of judgments on cases submitted to it. The work of th Council is most important. Here we have a Body of five representatives Great Powers, permanently functioning, and nine elected representative of other States, which are changed from time to time by elections to th Council in the Assembly of the League. This Body meets about thre times a year. Before it are placed any disputes or issues likely to give ris to disputes and also all plans for common action by Governments. large and varied experience during the years since January 1920, when th Council first met, has established new methods, new skill, new knowledge in international politics. The Secretariat, through which th Council acts, has played a part in the formation of a new diplomacy b providing a point of view with regard to international affairs which is n that of any one Capital, and by frequent travel and contact with th Administrative Offices of different States. But perhaps the chief advanta of Council meetings has been the personal contact between responsib Ministers of the Great Powers and other States. Before the War of 191 1918 the Foreign Secretaries or Ministers of Great Powers never me each depended for his knowledge of the policy of other Foreign Ministe upon Embassies abroad. Again, the current business of internation intercourse did not involve more than bilateral “ conversations.” No under the League system the Foreign Secretaries and other Ministe meet personally at fixed intervals at Geneva, that is, in a “ neutral atmosphere ; and they have before them not their own quarrels or t promotion of their own national interests, but the common business of peoples. If disputes are to be discussed, these disputes may not direct affect most of the members of the Council ; they are therefore able to s inadequate a ground for war or the threat of war a dispute is, when someone else's dispute. This may indirectly dwarf their own disputes, ıey arise. But secondly, the members of the Council learn to act ther for the solution of disputes or the prevention of a crisis. Quite t from the success of the Council in adjusting some rivalries (for nple, the British-Turkish rivalry in Mosul), and the failure in other utes (for example, the Finnish-Russian dispute about Eastern elia), much has been learnt as to methods for preserving an " atmo- re " within which conflicting interests can be prevented from leading ar. The value of Article XI. of the Covenant has proved to be very t. The policy of peace is seen to be, not the mere treatment of a crisis ne solution of a dispute, but the preservation of contacts which may sulate " the tendencies to war which exist in every nation. The ess of the League system of conciliation has shown that even if no could prevent war after a crisis, such as that of July 1914, had arisen, can prevent such a crisis arising. There are obviously tendencies rds war in the policy of every State—especially that tendency which to preparation for future war. Fear and suspicion survive; and are groups of men and women who, perhaps honestly, believe it to neir duty to play upon such fear and suspicion. But such tendencies such groups need not cause actual war if they are " insulated," that say, if the close contact of responsible Ministers through the Council the free discussion in the Assembly of the League allow those to perate who, in every country, prefer peace and think it possible in all mstances.

ne other aspect of the Council's work is common action for purposes ed to be good for all nations—for example, the conquest of epidemic se, the restitution of economic stability, the control of noxious drugs, aising of the standard of life of workers in " backward " countries. again, what is most valuable is not the actual work already done ugh the League system, but the habit of co-operation and skill in co- ation which modern Governments are learning. What has been done rely an indication of what may yet be done. We are at the beginning ur task in modernising government. Such modernisation is still pered by atavisms, as in the expenditure on preparations for a future but although it seems to be difficult to reduce fear and so reduce ments, other interests are gaining the attention of statesmen and ary citizens. The increase of attention to more civilised issues than ence," to public health, to commerce, to the raising of the standard e, may divert energies now largely wasted in preparations for war. peration for common interests, therefore, however unimportant interests may seem to be, tends to create an attitude of mind which rs peace rather than war. Even in that part of its work which is not ted to the prevention of war, the League is making peace more e because more valuable to ordinary folk. Politically, then, in the ue system we have advanced greatly within the past ten years. A rn State is obviously not a separate unit, but part of a State-system ting through meetings of responsible Ministers, through an inter- nal Secretariat and through the increasing contact between the nistrative Offices of the different States.

The membership of the League for the first six years of its existenc did not include Germany ; and for the first twelve it has not included th United States or Russia. Turkey also does not belong. But the absence o the United States and of Russia as members has not prevented experiments in modern government in the international field. And in som issues the Governments of the United States and of Russia have co-operated with the League. Such co-operation tends to increase becaus of the obvious utility of the system to all modern Governments ; an perhaps by slow steps the opposition against accepting membership in th League may be modified by practical co-operation. There is already tendency for critics of the League to say that it would be best to hav another League of the same sort ! Even the obvious defects of the existin League system show the need for exactly that system—of course, withou its defects. Suggestions for the creation of a World-State, in place of co-operation between existing Governments, disregard actual experienc They are Utopian in the sense that they refer to no place at all. But eve such suggestions imply the necessity in the modern world for the recognition of common interests as the basis of the political organisation connecting peoples.

This general view of the position in international affairs of the Leagu system of co-operation, in conciliation and common action, needs to b supplemented by a note upon the principles underlying certain new task undertaken through the League. For example, some religious and racia Minorities have been given by Treaties and Declarations the right c complaint to the Council of the League. Many States contain sections c races or religious groups which are minorities by contrast with the race c group dominating the State, as the Ukrainians and Germans in Polanc the Germans in Czechoslovakia, etc. Some such minorities have no righ under Treaties or Declarations, as for example the German or Sla minorities in Italy. But the others can make representations before th Council. In cases in which acute feeling has not been excited, the Leagu system has provided some appeasement or adjustment of rival interests but in other cases Minorities have had no redress for the grievances fro which they say they suffer. The situation is by no means stable : man evils undoubtedly exist, which are due either to the tyranny of a majorit or the " irredentism " of an excitable minority. But some differenc within the past ten years has been made by the admission of inte national responsibility for preventing oppression within the frontiers c certain States ; and, at any rate, some attention has been given to thos who have not the power to enforce their claims. Here is a principle c international organisation which will inevitably affect the traditiona view of domestic jurisdiction, of sovereignty and of joint internationa responsibility.

Another example of common action undertaken by the League is th Mandate System. Certain territories, lately under Turkish and Germa jurisdiction, are now administered or controlled by France, Great Britai Australia, New Zealand, the Union of South Africa and Belgium, und mandate from the League. The principle involved has been labelle " Trusteeship." In the case of ex-Turkish territories (the A Mandates the Mandatory is supposed to assist but not to undertake complete contro idea seems to have been that France and Great Britain would, after a for development, hand over to local political organisations the onsiblity for government and the power to govern. In the other cases nd C Mandates), where the peoples were still in the main primitive, Africa and Polynesia, the Mandatory would fit the people for self-rnment; but evidently it was felt that this was in the far future. ntime the Mandatory would take over complete control and report e Council of the League upon what it was doing. To receive and ine these annual Reports, the League set up a permanent Mandates mission. In practice this Commission has criticised some actions of Mandatories; it has received criticisms of the Mandatories from ns resident in the area under Mandate; and it has suggested some ls of policy. This organisation therefore represents a new form of national responsibility. The European peoples thereby recognise joint duty towards non-European peoples under their control; and the case of Minorities, although many grievances remain un-ssed, the situation is better than it would have been without the datory system. Trusteeship, however, involves a claim on the part Trustee that he knows what is good for his ward; but if the ward ther a child nor an imbecile, he may have his own views on what is is good.

doubtedly it is a step forward that many Governments should nise in practice the international aspect of colonial administration olonial economic policy. Clearly, in the modern world, what happens rench colony in Africa directly affects what happens in neighbouring h colonies; or again, the Union of South Africa cannot treat Africans r badly without a reaction among Africans outside the territory of Jnion. Further, skill in tropical medicine and the organisation of ies of tropical products require international co-operation. In so herefore, as the Mandate system provides machinery for practical eration in colonial policy, it is useful. The common relationship of peans to non-Europeans under their control, however, remains guous. Trustees who are determined that their wards shall never to be wards are indistinguishable from those who, with the noblest sions, are too ignorant or too incompetent to perceive the limits of own abilities as Trustees. But it is doubtful whether Europeans do know what is good for non-Europeans. It is not impossible that hould learn—from non-Europeans; but they must first unlearn uperior airs. The Mandates system may do more good to Europeans the non-Europeans for whose sake it is supposed to exist. However, step forward from the Congo administration of 1908 and the bland acency of British colonial government in the nineteenth century, ch it was assumed that nothing valuable was to be learnt from ers.

League system provides a means whereby each nation, through its nment, may learn something from every other one. This is not an on of sovereignty, if sovereignty means responsibility; but it is an nining of " localism " and village-pump politics. It is a means by each people may learn to look beyond its own frontiers; and see those frontiers not armed camps but markets. A market, in that sense, however, is not merely a place for exchanging goods and service It is also, as the *agora* was in Athens and the *forum* in Rome, a place f the exchange of ideas.

Within the League system is the International Labour Organisatio operating as described above.[1] Here a new principle has been used. T Governments are represented, as in the League Assembly and Counci but there is also representation in the Conference and Governing Bo of the I.L.O. for organisations of employers and trade unions of t different countries which are members of the Organisation. Therefo the principle of " functional " representation has been established international affairs. The " interests " represented are not all nationa and the rivalry between " interests " is not the same as the rival between Governments. In practice, the divisions on votes in the I.L. Conferences are not national ; for the trade unionists of different cou tries tend to act together and so do the employers. The issues discuss are not " defence," prestige and other such obsolete policies, but the c of production, the hours of labour and the use of leisure. The I.L. Conference has no power to compel action on the part of any Gover ment or Association ; but it passes Conventions and Resolutions social reform and the improvement of industrial organisation, whi have great influence upon Governments and may be made the basis legislation in the different States. Thus, in principle the I.L.O. stan for an international policy in the raising of the standard of living in nations.

Also within the League system, but not entirely, is the Perman Court of International Justice.[2] This is the latest development of principles which were at first embodied in the Resolutions of the Ha Conference of 1907 and in the Court of Arbitration then set up, wh continues to exist. The Permanent Court of International Justice, h ever, is significant of the progress made since 1914. It came into operat in 1922, and since that date has had before it important problems interpretation of Treaties and actual disputes between States. Its jud belong to many different nations. It holds regular sessions; and up December 1927 it had given fourteen advisory opinions and thirt judgments or orders. For the first time in history, therefore, there competent Court based upon co-operation between States in the format of a single juristic system covering the whole world. Some States, as the case of the League Assembly and the International Labour Organ tion, do not co-operate with the group of States maintaining the Co But in spite of the suspicion and criticism of citizens of States wh have not yet developed international co-operation so far as others, League system is accumulating experience and strength.

The daily activities of administrative or official bodies in mod government are more important than occasional legislation or the of a judicature ; for government is now a continuous process, not occasional intervention or corrective. Thus the value of the Lea system must be estimated rather by reference to its day-to-day serv ı by reference to the settlement of occasional disputes ; and if this is applied, it is more easily understood that the system now for the time established may become the basis of an entirely new relationship veen the peoples of the world.

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[1] For details see G. A. Johnston : *International Social Progress* (1924).

[2] See A. P. Fachiri : *The Permanent Court* (1925). J. W. Wheeler-Benn *Information on the World Court* (1918–1928).

THE DIPLOMATIC SYSTEM

he League system, however, operates within a complex of older tutions, of which the most important, in the relation between States, *ıe diplomatic system*. Indeed, the chief issue for the future may be ther the old traditions of diplomacy will submerge the new principles ied in the League or the League system will transform the old tices of diplomacy. Diplomacy to-day is largely the result of the em of communication between Governments that was prevalent after European Renaissance, when " sovereign " States first came to be bases of social organisation. Thus diplomatic practice generally ies the assumptions of Renaissance " sovereignty." A State, on such mptions, is a closed system of government, over against and entirely out responsibility to other States. The world of States is conceived an anarchy of atoms, not a system. But the States exist on the same h and occasionally come into contact ; therefore they keep officials, assadors or envoys, resident within the territory of other States, to st these contacts. Each diplomatist is supposed to act for the advant-of his own State ; and no common interests are assumed to exist. des, since war is always possible, diplomacy, with its naval and ary attachés, must spy upon possible enemies.

iplomacy in the modern world is in difficulties. It cannot refuse to gnise that States are still armed bands : and since war and the pre-tion for war involve secrecy and secret bargains, diplomacy is ed for the primitive tendencies under which it has to operate. But odern times many diplomatists have endeavoured to overcome the ıal suspicion of peoples and the rivalries of Governments. The y system, which has been the basis of International Law, is largely esult of progressive diplomacy. Nowadays, in every great capital, ıe States of the world are represented in a diplomatic corps of ıssadors and envoys ; and, in spite of surviving hatreds and jealousies, ommon interest of all modern peoples is felt to be peace. Peace not be secure, if the situation at any moment is so stabilised that ances cannot be redressed ; but in the Covenant of the League it is nised, first, that Treaties may have to be revised and, secondly, that macy provides means of adjustment for contending claims even de the League system. If therefore diplomacy can be used for con-us readjustment of the claims of different States upon the basis of ımon interest in progressive peace, the old system will be dominated ew principles. Instead of a mere bargaining of opponents or rivals, d from time to time with a threat of armed force, diplomacy will t some interests common to many peoples or to all. Instead, for ple, of the British diplomat thinking only of British interests, he onsider the interests of common folk in all nations, in terms of and bread, not of prestige and power. This may be what is meant by those who use the phrase “ the new diplomacy ” ; and i follows from such purposes that the means used cannot be deceit an secrecy.

For such a transformation of the old method of diplomacy, change of personnel and of organisation may be necessary. Already the telegrap and the telephone have reduced some Embassies abroad to post-offices An ambassador at the end of a telegraph-wire, the other end being i control of a strong Foreign Secretary, has not the responsibility or powe of the diplomatist in former days. Besides, some States have recentl improved their diplomatic services by democratising them ; for men wh know nothing of industry and commerce, or of the life of the majority o their own country, are hardly good representatives of that countr abroad, now that common folk have political power. The days of th courtier and the diner-out in diplomacy are gone. The modern State as was shown above, is a public service organisation ; and naval an military attachés are merely survivals. Commercial attachés and Counsellors have been appointed by some Governments ; and the consula service is now not so carefully separated from the diplomatic. But th system of diplomacy in most States is still pre-modern ; and therefor modern international organisation is still only beginning in the diplomatic system. The personal contact of responsible Ministers in th League system and the new assumption on which that system rests– that common interests take precedence—may transform, withou destroying, the use of diplomatists in all capitals. Even the Foreig Offices, which are supposed to be points of contact between Government and are usually, in undemocratic States, staffed by a social upper clas may be brought more closely into contact with commerce and cultur Modern international life may thus penetrate into the formalities of th old tradition.[1]

VOLUNTARY ASSOCIATIONS

Since the War of 1914–1918 many groups for association across frontiers, for the promotion of common purposes, have been strengthened o have come into existence. The Interparliamentary Union provides Conferences for Representatives in National Assemblies who favour peac Since women have gained, in most modern States, the political franchis their associations have become more powerful—for example, in th international sphere, the Women's International League and the Inte national Council of Women. As an example of a new growth may b cited the Federation of League of Nations Societies, which holds a annual Conference in a different country each year, through which th groups that work for peace in the different nations may co-ordina their policies. Similarly, the World Alliance of Churches holds Conferences for representatives of Protestant religious bodies from man countries. The growth in the membership, in the power and in th prestige of such bodies since the War has been very important. It ma indicate that the interests in peace will overcome the tendencies towar

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[1] See H. K. Norton : *Foreign Office Organisation* (1929), and R. Nightingal *The British Foreign Services* (1930. Fabian Soc. Pamphlet).

; but a candid review of the groups concerned leaves it doubtful ther they have enough political weight, enough real sympathy among r members, apart from rhetoric, or enough hold upon the soil of mon life in the different countries which the members of their rnational Conferences are supposed to represent. Twenty old gentle- . and ladies may come together from as many nations and agree and solve " that peace is good ; but such " resolutions " have no political ificance. It would be a mistake however, it *is* a mistake made by omatists, to underrate the sullen resolution to avoid war which still ives among common folk in all nations. Even in those nations whose ernments find it convenient to play upon the fear of foreigners, war ot yet appetising. Glory is tarnished ; and victory evidently does not We may be still a long way from such international organisation in relation of Governments as will make war impossible ; but the hesita- among common folk to resort to armed conflict for the redress of vances still paralyses the efforts of young enthusiasts who suffer the atavism of violence as a policy.

nong the international institutions in the political sphere, the Labour Socialist International (the so-called " Second International ") is important. In this Association the Socialist Parties of many different tries maintain a Bureau and organise periodical Conferences. The s discussed include not only war and peace, but colonial government, l legislation, the machinery of government and the organisation of uction and consumption for public advantage. The constituent es of the International are entirely autonomous ; but they are able o-ordinate their policies in their several Legislatures by means of ission with Parties in other countries. This is a pre-War institu- revived ; and it is now secure against a rival institution, created maintained by the Moscow Government, called the Third Inter- nal.

ow far the Third International can be treated as representative of rent national groups may well be doubtful. It is supposed to unite olicies of Communist Parties in all countries ; but its meetings and utions are so completely dominated by the small national group in ol of the Government in Moscow that its policy is more like Russian perialism " than a genuine internationalism. There are, however, rful Communist Parties in Germany and France, as well as in a ; and if the Third International does include any real contributions ought or policy from other groups outside Russia, then it may be dered genuinely international.

e main point to be remembered, in any analysis of modern inter- nal organisation, is that we are dealing with life and not with a situation. The actual institutions of to-day in the international both official and voluntary, are only signs of the vitality which is elling co-operation between peoples of different races, languages raditions. There is a necessity even in human action. It is indeed ecessary that men should desire more food or more leisure ; but if y chance they do, then they must necessarily work for peace. , in that sense, is not a mere cessation of war. Indeed peace cannot until the preparation for war has ceased. But even that is not peace.

Peace is the skilled organisation of co-operation between peoples, through their Governments, for the advancement of civilised life.

THE THEORY OF INTERNATIONAL ORGANISATION

The theory of international social life or world-intercourse is ridiculously inadequate. Indeed it can hardly be said that a modern theory exists. Books on political science and social philosophy are still published in all countries, which imply the obsolete assumptions of the past ; for example, the State is discussed as if its characteristics could be discovered by analysis of the " internal " structure of government or the relation of a Government to the subjects or citizens of which it is the Government Perhaps a note in such books, or a concluding chapter, attempts to make some reference to the existence of other States, Governments or peoples but the original assumption, that a State is a separate unit of government still survives. It is not yet understood by political scientists that the State cannot be defined in isolation—that a modern State, in fact, is an integra part of a State-system. Some of the most important characteristics of modern State and a modern Government arise out of their relationship to other States and Governments. Similarly, the analysis of civilisation continues to imply that civilisation is a local growth, with occasiona external or foreign contacts. But, in fact, modern civilisation is essentiall world-intercourse. Political science, therefore, in this matter is not ye based upon the facts of to-day. And as for " social psychology," which should have added something to the conception of world-intercourse some of its authoritative exponents seem to be ignorant of actual socia experience. The most fantastic abstractions are made with regard, fo example, to a supposed " pugnacious " instinct and to a " herd-mind which is supposed to dominate foreign nations ; and no attempt is mad to study psychologically such actual social experience as banking or ship building. Again, it seems to be believed that it is social psychology, if class of individuals is studied and contrasted with another class. Thu we have statements about negroes and white men, or about Frenchme or Americans, based upon the examination of a logical " class " o separate individuals. This may be useful ; but it is not social psychology It is valueless for the theory of world-intercourse, because it discusse logical classes and not groups of men in relation. What is socially impor ant is not the difference of a negro from a white man, but the differenc of the *relations* between negroes and the *relations* between white me Social psychology should pay less attention to logical classes and stud the relation between members of groups.

The general conclusion indicated is that there is no modern theory international intercourse, except in hints and suggestions. What the would such a theory be, if it existed ? First, it would be an account the most general or pervasive characteristics of contemporary worl intercourse. It would in that sense be an abstract science, a system colourless and, as far as possible, unprejudiced statements. But theo in the social sciences is inevitably close to plans for action. Indeed, the social sciences one cannot even make an abstract theory witho affecting action. Thus the mere statement that Law is Command mak ı treat Law as if it were Command ; for Law is in the minds of men. do not in the same way affect molecules when we say that they are nic. They do not hear our observations ; but men do.

ı the second place, then, a theory of international intercourse is a s for action. Let it be assumed that ethics, or moral philosophy, is being discussed here ; let it be assumed that we know, sufficiently practice, what a good man is and what kind of society is desirable. s having been granted, the theory of world-intercourse will suggest e of the conditions under which good men and a good society may rought into being. For example, if it is good to have soap and motor-, it is good to have peace as a means of obtaining soap and motor-. But peace is not simple. It involves justice, liberty and order in the acts between peoples. And all these require knowledge of national acial psychology, of institutional experience, and of the incidental cts abroad of local habits. The knowledge of such facts, again, is ess without the ability to lead or the skill in influencing men, which titutes the art of government.

he modern theory of international intercourse is based upon experi-, and perhaps upon experiment. It changes as conditions change. It ıot now rest upon the abstractions of the Renaissance, upon which eat part of the theory of International Law is based. The beginnings modern theory, however, of the relations between peoples may be d in two sections of the subject ; first, in the relation of " advanced," ontrolling, peoples to less powerful peoples ; and secondly, in the ion of equals—the theory of the obsolescence of war.

he old imperialism implied that superior races or nations must rn others. Similarly, Trusteeship implies superior wisdom in those administer the Trust. As described above, the Mandate System er the League of Nations is an attempt to improve the principles of nial government in certain areas. But, as also indicated above, it is monly assumed by European peoples that they know what is good ıon-Europeans under their control ; and here the theory of their ionship must be discussed. In the old imperialism control was ı by the more powerful nation. In colonial territories the Trustees appointed themselves. The system is benevolent alien dictatorship. purpose of those in control may be to improve the races under their ol, for the common advantage of all the peoples of the world. But actice no nation in control is willing to lay down its power : for ntly each gains something from it—something more tangible than ense of his own benevolence in governing other peoples for their . Obviously, the people of Great Britain, France, Holland, Italy, um, and Portugal, as well as the Japanese in Formosa or Korea, e some wealth from colonial territories. But the Mandate principle, usteeship, which cannot logically be applied only to ex-German and urkish territories, implies that all control over so-called backward es should be exercised for *their* advantage chiefly. What then is advantage ? Who, better than they themselves, knows what it is or to get it ?

e " strenuous conditions of the modern world," as the Covenant of eague puts it, means in plain prose, the pressure of European peoples for the obtaining of oil, cotton and rubber. It may be an advantage to subject-peoples to sell such goods to Europeans. They may receive in return some European organisation of health, some very restricted education and some few commodities. But neither European trade nor European government has so far raised the standard of life of " backward " races more than just enough to secure supplies for Europe. A modern principle of the relation between peoples could not allow the continuance of the current practices of colonial government. Europeans are too ignorant of the peoples they control. Social anthropology is only just beginning ; and it is still academic. But more fundamental still—the assumption of European superiority, as more than a passing phase, cannot logically be maintained. Other races are indeed now in a social state from which we escaped some centuries ago ; but there is no evidence to show that they are not as capable as we have shown ourselves to be in the modernisation of ancient customs. The danger of Trusteeship is that it may *delay* the development of backward races. It is tempting for those in control to be slow in making those under control fit to escape from it. A modern prison, as the warder thinks, is very good for the prisoners ; they would only come to harm if they were not under supervision ! Thus the theory of Trusteeship itself has its dangers, even if we assume, what must be obvious, that the theory of slave-labour, still dominant in South Africa, is obsolete.

The only valid modern theory of the relation of races or groups at different stages of development is that they must be assumed to be fundamentally equal in rights and status, although at any moment one race may not have developed to its full stature. Just as the best teacher stands aside when the pupil is educated, so modern nations must stand aside when the other races which they control are able to govern themselves. And if they are not so able, after many years of control by others that is a condemnation of their controllers. The relation of the peoples of Asia, who are by no means primitive, to the wealthier and powerful European peoples is already that of equals. Modern political theory assumes that the Chinese, for example, are not to be taken over as subjects by any European races. The same is true of India. Trusteeship is already inapplicable in most of Asia, where ancient civilisations survive. But in Africa, and in some tropical areas elsewhere, there are races which are not yet able to govern themselves. Even these races, however, in the modern theory of international organisation, are likely within the next fifty years to dispense with European control. The influence of modern commodities and modern ideas will render alien dictatorship impossible everywhere. A long-sighted policy, therefore, would provide that the obsolescence of alien control shall not be followed by chaos ; but if the controllers are unwilling to see the writing on the wall, chaos will come. African and other tropical races are now beginning to claim a larger share in the advantages derived from their labour. They may not make that claim by force of arms, for the boycott is more modern and more disastrous in its effects upon Europe and America ; but the claim to be free of alien control is now being made everywhere. The relation of races, controllers and controlled, which we glibly label Trusteeship, is therefore one of the most difficult of all the issues in international organisation ; and the modern ry of that relation is quite different from the theory of Imperialism " the white man's burden," as understood in the nineteenth century.

THE CONCEPTION OF "DEFENCE"

for the relation between peoples regarded as politically equal in s, the attempt is now made to avoid the consequences of Renaissance reignty. It is agreed that autonomy should not imply conflict, or preions for conflict; and some have spoken of the outlawry of war by n, if anything definite is meant, war is conceived to be not a legal for any gain. Such a conception would undermine the practice of *majeure*, of violence as a basis for Treaties. The moral effect upon ng Treaties, which have been the results of war, might be revolury.

States in fact are armed against other States; and all Governments reparing for war against other Governments. The more modern the , the more effectual its preparations, the more destructive the ons it purchases, and the more subtle its spy-system and secret ments with possible allies. But nowadays each State and each Govent is armed only for " defence." Aggression is not regarded by any e as a possible policy. War as a means of increasing power or wealth longer publicly advocated or officially countenanced. Only " de-" is regarded as justifiable. On the other hand, defence is force for ing " aggression "; and all States, against whom any State might to defend itself, are armed only for defence: therefore no danger be anticipated from any foreign arms—unless, of course, what ners say is not to be trusted. But if foreigners are not to be trusted, any other State is justified in distrusting *our* statement that *our* arms ly for defence, because we are foreigners to them. Again, defence eapons is necessarily regarded as possible aggression by anyone t whom the weapon can be used. What to one nation is defence of gitimate interests is to another unjustifiable aggression. Yet each is treated as the only judge of what constitutes defence in its own A gun has two ends. From the breach end it is " defence "; but not the other end. And in fact the reason why the British are increasing war-aeroplanes is that the French are increasing theirs; and the h are increasing theirs because the British are increasing theirs. We t agree to halve the defence on both sides against the defence on sides, because neither side trusts the other to carry out such an nent. Thus fear and suspicion breed the preparations for war— increase fear in other nations and therefore lead to the very war t which they are supposed to insure the world.

a further act in this comedy, some have evolved the theory of ual defence." It seems reasonable enough to argue that the maine of peace is a common interest, and therefore should be achieved nmon action. Again, that France should be " secure " is an innot only of the French but also the British; and *vice versa*. The sion is made that the arms of each should be used for the " mutual e" of both. It is further said that armed forces are like police, ining a common peace. Therefore, it is argued, they should act together. Other metaphors and analogies are used, as in the reference t the “ posse comitatus ” of the British tradition and the duty of all good citizens to assist one another against criminals. By such arguments and metaphors the so-called “ policy of security ” has been supported, and ha been made the basis for such action as the French and the Czechs believed to be promised in the Geneva Protocol of 1924. The nations i Europe which have derived advantages from the events of 1914–1918 have looked to “ mutual defence ” as their best means of securing thei gains. These nations have played with the word “ sanctions,” as if in war, which is the result of many years of the policy pursued by many nations, there could be one side which was virtuous and the othe criminal.

The theory is misleading and, in some forms, a travesty of facts. First “ defence ” is quite impossible against those who are only defendin themselves. If mutual defence is necessary, there must be some “ aggressors.” And if armed forces are “ police ”—police are not organised agains other police ; therefore armed forces, on one side, must be police and on the other, “ criminals.” The conception that a modern State or Government, which is treated normally as defender and police, can suddenl and, as it were, in a psychological or moral lapse, become an aggressor o a criminal, is primitive social mythology. It is comparable to the theological idea of a “ guilty race.” Modern war is not made in a day or a wee or a year. And again, the criminal in fact is disobeying a law to which h is presumed to have given consent. But no nation is disobeying a law t which it has consented, if it is, in its own eyes, defending its rights. Historically, the whole policy and theory of aggression and of crimina nations are due to the propaganda used on both sides between 1914 an 1918. In short, there is no escape from the absurdity of the conception o defence against defence by extending the area from which any supposedl virtuous nation can seek its defence. So long as any defence against othe Governments is conceived to be necessary for any State, so long are ther “ possible enemies.” And the mere suspicion that some Governments a “ possible enemies ” poisons the whole of international intercourse an hinders the modernisation of the State-system. The members of th League of Nations cannot possibly regard one another as potential aggressive criminals, while they co-operate in common services for publ health or commerce. The situation is ridiculous.

THE THEORY OF THE STATE-SYSTEM

A modern conception of a State in its relation to other States repudiat the assumption on which “ defence ” depends. It involves rather th each State is fundamentally and essentially a part of a single government system covering the whole earth—that each Government, therefore, is instrument by which its citizens *assist* the citizens of other States. Spyi and other preparations for war are atavisms. The conception of “ d fence,” as an excuse for armaments, is a psychological cover. War force and fraud, organised by one State against others ; and neither these is useful or necessary for modern government. The analogy of t need for force against individual criminals or dangerous lunatics cann

pplied to the relation between Governments, as it could not be applied
e relation between Universities or trading companies. The new situa-
as between States, is like that between local government authorities.
county does not defend itself by its police against the police of the
ıbouring county ; one province in Canada, or one State in the United
s, does not defend itself against the others, for each such institution
s for the same purpose as its neighbour. We can already see that the
h of the citizens of Great Britain is an advantage for the citizens of
ce ; but we have not yet grasped the fact that the law and liberty of
t Britain are essential for the law and liberty of France—that dis-
is like an epidemic disease. We have not yet grasped the fact that
is no need for Great Britain to be " defended " against France, nor
rance to be " defended " against Germany.

the modern conception of the State-system, there are of course
e-forces for the suppression of crime or private violence ; but there
theory of " defence " against any official institution or other State.
is irrelevant to the modern theory is the fear of aggression ; and it
r, not aggression, which keeps States armed against other States.
problem of disarmament is not a problem in defining aggression,
problem in abolishing or diminishing fear ; and the conception of
al defence only confirms fear. Men cease to fear their neighbours,
hen they are stronger than those neighbours, but when they do not
in terms of comparative strength. Thus the modern view of the
-system indicates a policy, which is that of creating mutual confi-
by the habit of co-operation.

is is no easy task. Suspicion of foreigners is old ; it is maintained by
ance and inattention ; and it is easily developed by any person or
able to excite fear of the unfamiliar. Again, apart from suspicion,
sm is traditional. Each linguistic or " custom " group tends to cen-
al thinking ; it examines its own entrails when it is unwell and
s its own ability when the weather is fine. This nationalistic egoism
ds into commerce and finance. Thus co-operation between Govern-
s or between groups in different States must develop slowly. Small
s exist in every State who cannot think in modern terms. For them,
f foreigners is as natural as fear of the dark may be to children.
ry fears breed nursery policies, for example, in playing at soldiers.
gners are regarded as beasts of prey, unintelligible and therefore to
pected. A group with such ideas in one nation, playing at soldiers,
ms the fear of a similar group in another nation ; and thus " proves "
satisfaction of each such group that the other nation is a possible
, an aggressor or a criminal.

ractice, the very groups which live upon fear of foreigners dominate
policy in most States. The majority of men and women in normal
never think at all of the foreigners, on whose labour they depend
food they eat. Thus in normal times the group that is preparing
ure war is left a free hand in its preparations, which alarms similar
s abroad, who therefore hurry on with their own preparations. The
t of this old comedy occurs when the generals and admirals, whose
t is to regard foreigners as dangerous and suspicious, are placed
Commissions for disarmament or the reduction of arms. The users

of arms are treated as experts in the discarding of arms ; and quite naturally they can think of no alternative but new and more efficient ways
(by mutual defence, etc.) of using arms.

It cannot be denied that groups, which assume that violence is a means
of maintaining the rights or interests of a State or its citizens, do have
great influence. The Committee of Imperial Defence in Great Britain,
for example, is very powerful in deflecting or in directing the foreign
policy of the British Government. Again, it cannot be denied that violent
groups may take control of the Government of any State and thus become
a danger to any other State. Practical politics requires the elimination of
such influences *within* the States of the world before peace *between* the
States is secure. Theoretically, in a world of States already disarmed
some assistance might be required within any State for the suppression
of violent groups within it. And in such a world the police-forces
of all States might have to act together. But that is a situation in
which Governments no longer rely upon force of their own as against
other Governments—in which, therefore, armed forces are really police
forces. And that situation implies complete mutual confidence as between
Governments and the citizens of those Governments. The world a
present is not like that. The preliminary work of taking any one State ou
of the hands of those who do not understand any instrument of policy bu
force has not yet been done; and probably it cannot be done by direct at
tacks upon militarism and the tendencies towards militarism. " Changin
the subject," however, is a good policy. The obsolescence of war
mentality will probably occur, not through attacks upon war, but throug
increased attention to details of co-operation between Governments
When men acquire the habit of acting together for specific commo
purposes, they lose fear and suspicion of one another. When Government
cease to " defend " their subjects from foreign bombs in times of war an
foreign oranges in times of peace, they will learn to think of oranges an
not of bombs. And when scientists are able to distinguish between th
possible uses of science, they will not devise new weapons, as they d
not now invent new diseases. There was a time when scientific ingenuit
was devoted to the manufacture of new instruments of torture ; but we d
not use torture now and therefore science has been applied to other pu
poses. Future ages will look back with astonishment at men, calling them
selves civilised, who now devise new weapons for the destruction of the
fellow-men, at the call of what they imagine to be patriotism ; but a
present one of the chief causes of the fear which leads to war is the em
ployment of science to make war more destructive.

The theory of international intercourse finds its chief obstacle in th
assumptions which give rise to the inherited conceptions of patriotis
and the " nationalism " of modern times. If one's country is falsely co
ceived to be civilised by isolation and segregation, then naturally th
fear of foreign influence can be believed to be " patriotic." But no civilise
country has developed its own civilisation by itself. Its science, its manu
facture, its government itself, are the result of an interchange of ide
between many different nations. Indeed it has been well said that nothin
is truly patriotic, in the old sense of that word, except barbarism. Fran
in the eighteenth century, for example, became more civilised, not throug

wars of Louis XIV, but because of the trade and the science of men
noticed by the historians. And whatever may have been true of the
t, at present the civilisation of each country and its true greatness
end, not upon its security from foreign influence but upon a con-
ıous and complex interchange with all foreign countries. Modern
:iotism—modern love, that is to say, of one's country—makes one
ceive the need of one's own country for international intercourse. The
: service of one's own country is not its " defence " from foreigners,
increase of its contacts with foreign countries. It follows that men will
er think of other nations as they should, until they can think and feel
ıt their own country in modern ways.

lodern international politics assumes that the common interests of
nary folk are the same, whether they live in France, Germany, Eng-
l or America. These common interests need no " defence " by armed
e ; but they do need co-operation between peoples of different races,
uages and traditions, because the common interests are health, food,
hing, leisure and the means of enjoying leisure, all of which are in-
sed by intercourse between peoples. For such purposes Governments
t, not for prestige, or glory, or even " defence of legitimate interests."
ere interests appear to be in conflict, there are modern methods, in
or diplomacy, for adjusting them or for avoiding violence, because
ence is a lunatic's plan for maintaining interests. Skill in the organisa-
of the State-system, upon a basis of world-intercourse, is rapidly
ving. The percentage of the primitive in all countries is being reduced
nodern education. The commerce of the peoples is increasing. Modern
is becoming too full of varied interests to leave a space for atavistic
s and suspicions. Men may soon become too busy to go to war or
to prepare for new wars. And when that situation is established, as it
well be before the majority of men realise what has happened, the
lish patriotisms, the narrow nationalisms and the appeals to violence,
still prevalent, will have disappeared. Men in all lands will then be
to work, with both hands and their minds free, for civilised life.

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THE SCIENCE OF HISTORY

By

F. J. C. HEARNSHAW

SYNOPSIS

history a science ? — Professor Bury's view challenged by both ɾal philosophers and literary men — Discussion of the question inating in the conclusion that history is a science closely akin e sciences of archæology and geology, although differing widely the physical and mathematical sciences — Aims and methods e science of history.

urvey of history and historiography in ancient and mediæval .

Survey of history and historiography from the fifteenth to the eenth century.

he beginnings of the scientific study of history in the nineteenth ıry : new aims ; new conceptions ; new methods — Influence of al science — The idea of evolution — Publication of sources.

oneers in the new historiography — Influence of the positivist sophy — Efforts of Comte, Buckle, Mill, and others to reduce ry to the rank of physical science — Resistance of Kingsley, de, Droysen, and others.

he uses of history — Relation of history to politics.

The recent widening of the scope and enlargement of the content tory.

THE SCIENCE OF HISTORY

I

Few professorial pronouncements in recent years have excited s much controversy as Dr. J. B. Bury's challenging assertion, twice uttere during the course of his inaugural lecture in January 1903, that " histor is a science, no less and no more." There may have been some point i his throwing down the gage of battle twice. For from two opposite side champions at once emerged to take up his challenge and enter into combat with him. On the one hand, natural philosophers came forward t contend that history is much less than a science; on the other hand literary men came forward to contend that it is much more.

The natural philosophers—men devoted to the study of the physica universe—maintained on their side that the data of history, unlike th data of the sciences with which they themselves were conversant, are uncertain and indeterminable; that no direct observation of the alleged fact of history is possible; that no experiments are practicable; that ever historical event is a unique event which in no conceivable circumstance can be repeated; that, consequently, no sort of exact classification c events is feasible, and that nothing of the nature of generalisations c scientific laws of history can be formulated; that, moreover, the data c history are infinitely complex; that there is no agreement among historians as to what is important and what is insignificant; that the elemen of accident in history destroys all calculation and frustrates all attempt a prediction; and, above all, that the apparent presence of personality an freewill in each individual man renders all efforts to establish history on scientific basis futile and even ridiculous. " A science of history," said Professor W. S. Jevons, " in the true sense of the term, is an absurd notion.

The literary men, on the other side, contended that, whether or n history is a science, it certainly is an art; that science at its best can provide no more than the dry bones of history; that the imagination of th poet is needed in order to make them live; and that, when they a imaginatively alive, the highest skill of the accomplished writer is r quired if they are to be decently clothed, and if they are to be presente in such a manner as to make them effective in the world. The literar men contended, further, that the passionless indifference of the man science is out of place and intolerable in the case of the historian who dealing with the affairs of sentient souls, since, as Professor G. M Trevelyan says, " the man who is himself devoid of emotion or enthusias can seldom credit, and can never understand the emotions of others."

So was the battle joined until finally a sort of permanent triangul stalemate was achieved, the men of science and the men of letters assaili not only Professor Bury, but also one another. Nevertheless, out of t hurly-burly one truth at length emerged obvious and clear. It was th

the conflict was largely a mere logomachy, or battle of words, and
a little preliminary definition of terms might have obviated the
ter part of it altogether. For both " science " and " history " are
iguous expressions, and unless they are carefully defined it is pos-
e, and indeed probable, that persons who use them in controversy
employ them in senses so diverse that they will really be arguing
t totally distinct and separate things, never coming face to face at
" Science," says Lord Acton, " is the combination of a great mass of
lar facts into the unity of a generalisation, a principle, or a law, which
ciple or law will enable us to predict with certainty the recurrence of
events under given conditions." No wonder, having formulated this
nition, he gives an emphatically negative answer to the question
n there be a science of history ? " But science, although, no doubt, it
ys seeks to generalise, always gropes after laws, and always covets
gift of prophecy, is by no means deprived of its name and character
fails to attain these goals of its ambition. The name and character of
nce, for example, are not denied to meteorology because generalisa-
s concerning the climate (particularly in England) are impossible (at
rate in parliamentary language), because the laws according to which
hine and storm succeed one another are as yet undiscovered, and
use the weather forecasts of the experts are usually wrong in exact
as they are precise. In spite of all this, meteorology is admitted to be
ence. For " science " can be quite accurately and adequately, as well
uite simply, defined as " systematised, organised, formulated know-
e." It is enough to give the quality of a science to a subject of study
it should be pursued with a single eye to the ascertainment of truth ;
it should be marked by a diligent search for all relevant facts ; that
ould be built up with a critical judgment from which all presupposi-
and prejudices have been eliminated ; and that it should be, so far
s content permits, reduced to the simplicities of uniformities, cate-
s, and laws.[1] There is, therefore, no justification *a priori* for exclud-
history, or indeed any subject whatsoever, from the rank of the
nces. And if, in practice, some subjects have to be excluded, their ex-
on is due solely to the fact that, when exposed to those tests of a
ce which have just been enumerated—search for truth, accumula-
of fact, critical judgment, elimination of prejudice—their content
hes away. Is such the case with history ? It does not appear to be
or in the stable qualities of human nature, and in the permanent con-
of man's terrestrial environment, history is provided with constants
st as real as the dubious atoms of the chemist or the elusive electrons
e physicist. History treats of the actions and reactions of essentially
anging man and essentially unchanging circumstance. What then is
ntent ?

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ofessor T. H. Huxley says, " By science I understand all knowledge that
upon evidence and reasoning " ; Dr. Alex. Hill maintains that " all
gent knowledge is science," and that " science is knowledge in
ective " ; Professor Karl Pearson shows that " the classification of facts,
ecognition of their sequence and relative significance, is the function of
e " ; while the American Professor, F. J. Teggart, defines science as
y " the systematic investigation of the processes manifested in
mena."

This question compels us to consider the connotation of the tern “ history.” And the most cursory examination enables us to perceive tha the word is used in several widely different senses. Ignoring, however finer shades of meaning, we may content ourselves with distinguishin the three following. (1) “ History ” is employed, conveniently no doubt but quite improperly, to connote *the actual course of events*. We speak o “ makers of history ” when we mean, not the writers of books, but me like Alexander or Cæsar or Napoleon, who by their actions have deflecte the stream of the world's affairs. We talk of the “ influence of history when we think, not of the potency of manuals, but of the power exerte by circumstances during the process of time. This use of the term w may dismiss. It is a terminological inexactitude which has to be permitte because unfortunately there is no other single word that stands for th temporal procession of the world's affairs. (2) The second importar sense in which the term “ history ” is used is that in which it connote the *narrative record* of the course, or of some portion of the course, of th world's affairs. This is a proper use, and it is the most common use. Thu we have histories of England, France, or Germany ; histories of ar science, or literature ; histories of anything and everything that ha evolved in the course of time and left traces of its evolution behind i But although this second use of the term is proper and popular, its employment leads to confusion. It leads, indeed, to that fundamental confusion which is at the bottom of all the controversy as to whether histor is an art or a science. For if history is a narrative, then it is a work literary composition ; and literary composition is an art. That is qui true. But the art of literary composition when applied to history is be connoted by the word “ historiography.” And if that word is employe controversy dies away. “ Is historiography an art or a science ? ” Th question has only to be asked to be answered : it is, of course, an art. Th way is cleared for the consideration of the word “ history ” in its thir and more precise connotation. For (3) “ history ” in its original and stri etymological sense means “ enquiry,” or “ learning by enquiry,” “ knowledge gained by a process of enquiry.” The underlying idea is investigation, research, persistent pursuit of the truth. And in this sense the word history is scientific, or it is nothing at all.

But if history in the sense of enquiry is a science or nothing at a what sort of a science is it ? What does it enquire into ? What is its subjec matter ? What are its aims ? What are its methods ? The answers to sor of these questions will be manifested more fully as this article proceec For it will be seen, when the history of historiography is surveyed, that different times very different answers to some of them have been authoritatively given. Here and now, in relation to the present day, the followi brief remarks may be ventured.

First, what sort of a science is history ? It is not, like astronomy, science of direct observation ; or, like chemistry, a science of experimer It is a science of criticism. Its nearest analogue among the natural scienc is geology. Just as geologists examine the earth as it exists now, in orc to find out, if possible, how it came to be what it is, so do historians stu the extant relics of the past in order, as far as they can, to explain t phenomena of the present. And just as geologists are dependent for th upon such scanty evidences of the operations that occurred in te epochs as have happened to survive in nature's chaotic rubbish-, so are historians dependent for all their knowledge of bygone events such concrete survivals, or such records and traditions, as may chanced to escape the all-devouring maw of time. These relics and ments and memories are the only present and tangible facts with h historians come into contact. They are the basal material of their ce. But they are valuable and important not at all for their own sakes, nly for what they reveal. They reveal past facts, yet even these not tly, but as seen through the refracting medium of the human mind. n the historian has eliminated, so far as he can, the elements of error his records and has extracted such pure and unadulterated fact as ins, even then he has not come to the end of his research. For be- and beneath all events and all monuments there lie the thoughts, cts of will, the emotions of which they were the manifestations or ations—ultimate facts of the human spirit wholly beyond the direct vation even of those in whose midst the events transpired or among n the monuments were constructed. It is for these hidden springs of n, these spiritual and enduring realities, that the historian, in the last t, seeks.

condly, into what does history enquire ? Briefly, it enquires into all existing relics and records of the past as seem likely to assist in the nation and elucidation of the present.

irdly, what is the subject-matter of history ? History, as such, in the tific sense of the term, has no subject-matter at all. It is simply a of enquiry. In order to acquire a content, it has to associate itself some adjective or other. Thus *political* history deals with past affairs te ; *ecclesiastical* history with the past affairs of the church ; and . And there is no adjective relating to the concerns of men with n it may not be associated. In other words, the sphere of history is as the sphere of human interests itself. *Quicquid agunt homines* : ng that men do or suffer, make or destroy, lies outside the scope of ical investigation. The muse of history can say, with Terence, *ni nihil a me alienum puto.*

urthly, what is the aim of historical investigation ? The answer has ly been indicated. It is : " the explanation and elucidation of the nt." All the materials with which history has to deal are actually ng materials : nothing that is entirely past and gone can possibly within its cognisance. Historical enquiry, moreover, has inevitably undertaken in accordance with the ideas and the interests dominant moment of investigation : no historian can abstract himself from nvironment. Nor, indeed, should he make any attempt to do so. is purpose as a historian is precisely to attain to an understanding f his environment and of himself. In short—as Professor Benedetto has pointed out—in a real and not merely a paradoxical sense of the ssion, all history is contemporary history, and all true historians illy-nilly, philosophers.

ally, what are the methods of history as a science ? This, of course, uestion far too big to be answered at all fully in an article such as esent. Those who wish to know the detailed reply should consult such books as the following : J. G. Droysen, *Grundriss der Historik* (1858) ; E. A. Freeman, *Methods of Historical Study* (1886) ; E. Bernheim, *Lehrbuch der historischen Methode* (1889) ; C. Langlois et C. Seignobos, *Introduction aux Etudes Historiques* (1898) ; E. Meyer, *Zur Theorie und Methodik der Geschichte* (1902) ; and C. G. Crump, *The Logic of History* (1919). Here it must suffice to mention the following main points which are emphasised by one or more of the writers enumerated. History as a science differs fundamentally from the physical sciences : it is, as has already been remarked, a science not of observation or of experiment but of criticism. Its data, Droysen tells us, " are not past things, for these have disappeared, but things which are still present here and now, whether recollections of what was done, or remnants of things that have existed, or consequences of events that have occurred." Its first task (*Die Heuristik*) is the collection of these data ; that is to say the accumulation of authentic facts. But since facts are infinite in number, and since the immense majority of them are of minor significance—although none is wholly without significance—some principle of selection is necessary. What principle of selection do historians recognise ? Probably no two wholly agree upon this crucial matter ; that is to say, probably no two, if set to describe the same event or movement, will pick out quite the same features as important. The older historians were attracted by the abnormal, the dramatic, or the heroic. They portrayed, in their best literary style, the unusual, the tragic, the sublime. The modern scientific historian, however, tends to select from the limitless data at his disposal just those facts which seem to him to help to explain and elucidate the evolution of human society as it exists to-day. Most of the original sources of these relevant data are documents, although other sources exist in such things as implements, buildings, earthworks, pictures, sculpture, and even oral traditions. Yet so pre-eminent in importance are the written records of the past that MM. Langlois and Seignobos go so far as to say : " Pas de documents, pas d'histoire." The collecting of data from documents involves a highly technical and eminently scientific training in philology, palæography, and diplomatic, into the particulars of which it is unnecessary for us to enter now.

When the relevant data of history—the raw materials—are collected the second process to be undertaken is criticism (*Die Kritik*). The statements of the documents, or the evidences of the other relics of the past have to be examined in order that their authenticity and credibility may be determined. Questions have to be asked, and so far as possible answered, respecting such matters—especially in regard to documents—as their original genuineness, their accurate transmission, the inherent credibility of their statements, the mental and moral condition of their writers.

The third and final process, prior to the synthetical construction of the historiographical narrative, is that of interpretation (*Die Hermeneutik*) the most difficult of all. It is here that genius such as that displayed by Leopold von Ranke, by Fustel de Coulanges, or by F. W. Maitland specially manifests itself. It involves the play of a scientific imagination capable of the highest flights, and yet restrained within the straitest limits of veracity—the sort of imagination that enabled the zoologist vier to reconstruct long-extinct prehistoric monsters from a few scat- ed bones that had happened to remain extant. For many periods of tory, and particularly for the Early Middle Ages of Christian Europe, documentary and other remains are so scanty, the ignorance, credulity, l mendacity of the writers were so great, the modes of thought and ys of life of the people were so wholly different from those of the men either ancient or modern times, that only the most supreme gifts of npathetic imagination—gifts of both intellect and emotion—are quate to an effective interpretation.

So much for the science of history as it is conceived of at the present . We must proceed, later on, to treat of the present position of the ence in Great Britain, on the Continent, and in America ; and, further, enquire into the relation of history, as now studied, to the life and ught of our time. Before, however, taking up these matters of the ment, we must turn back for a short space and survey the steps by ich the science of history and the art of historiography have reached ir present condition of development.

II

Although the conception of history as, in any sense, a science is a very ent one, nevertheless history as the record of bygone times has ex- d ever since man acquired the art of writing. And, no doubt, for count- ages before even that remote date, the story of still earlier ages was nembered and was transmitted from father to son by word of mouth. doubt, moreover, the purpose for which this ancient story was from to age recited and eventually recorded was precisely that same pur- e for which history is studied and written now, namely, in order to erpret and inspire the present. The earliest chronicles that have ne down to us—those of the Egyptians, the Babylonians, the Assyrians, the Hebrews—contain amid the records of many mere marvels (such he appearance of comets or the birth of two-headed cows) the stories livine providences and the tales of national heroes. The third century saw the almost simultaneous appearance of the Egyptian Annals of netho, the Babylonian History of Berossos, and the Books of the onicles of the Kings of Israel and Judah. But earlier than these were two Hebrew Books of Kings (about 575 B.C.), and still farther back out 900 B.C.) the Jahvist sections of the Pentateuch, Joshua, and nuel—the oldest historial works in the extant literature of the world. purpose of these works was, of course, didactic and pragmatical. The ers were very little concerned to investigate the sources of their in- nation, nor did they trouble themselves much about the accuracy of r assertions. Their business was to preach righteousness, to extirpate atry, and vindicate the ways of God to Man.

n striking contrast to the piety of the Orientals were the secularity rationality of the Greeks. These remarkable peoples had come as in- lers and invaders—from about 2000 B.C. onward—into regions where old Mediterranean civilisations of Crete, Egypt, and Asia Minor were ly established. It was the Cretan or " Minoan " civilisation with which they came primarily into contact. Much of it they absorbed ; but its mythological elements were so different from their own that out of the clash a general and healthy scepticism arose. The Greeks began to see things as they actually were, without the trappings of superstition. They sought for natural causes in respect of phenomena which hitherto had been assigned to the incalculable caprice of countless divinities, and when Thales of Miletus was able to predict an eclipse which the event (585 B.C.) exactly verified, an epoch in the emancipation of the human intellect was marked. The Greeks henceforth displayed a passion for enquiry—what they called ἱστορία, or history—and among the subjects of their insatiable curiosity were pre-eminently the affairs of the human race. They travelled widely ; they examined the ancient civilisations of the East and the novel barbarisms of the West ; they searched out the secrets of the past ; they never rested until they had attained to a rational interpretation of things. The first Greek historian known to us is Hecatæus, a fellow-citizen of Thales, born in Miletus in or about the year (546 B.C.) in which the great philosopher died. He wrote of the origin of the Greek peoples and of their early wanderings. No doubt he made many mistakes in detail, but his spirit was the right one. He had the scientific mind. " What I write here," he said, " is the story which I believe to be the true one ; for the legends of the Greeks are many, and in my opinion absurd." The successor to Hecatæus was the great Herodotus of Halicarnassus (*c.* 484–*c.* 425 B.C.), sometimes called " the father of history." He had a fine theme, namely, the conflict between the Greeks and the Persians, between Europe and Asia, between West and East. And he rose to the height of his opportunity. For he recognised that the struggle that was decided at Salamis, Platæa, and Mycale (480–479 B.C.) was a mortal contest between opposing civilisations and between wholly incompatible ways of life. Hence in his great work he presented us with priceless pictures of the rival cultures, and with an inimitable narrative of the course of a series of events on which the destinies of mankind depended. The third notable Greek historian, Thucydides (*c.* 471–401 B.C.), had a narrower though still important and interesting theme, namely, the fratricidal but eminently dramatic and fluctuating Peloponnesian war between Athens and Sparta (431–404 B.C.). He was much more careful than Herodotus had been to verify his statements ; he was far less inclined to wander from the main stream of his narrative into irrelevant (though fascinating) by-ways ; he had incontestably a superior power of story-telling. But on the other hand, his interests were more restricted ; he too much identified history with mere politics and war ; he failed to penetrate to the deeper causes of events ; he attributed too great an influence to the actions of individuals, *e.g.*, Themistocles ; he saw all things in a false perspective. Above all, he wrote history with a rhetorical—or what Croce calls a " practicistical "—purpose. That is to say, he regarded it not so much in the light of a science whose function it is to explain and elucidate the present, as in the light of an art whose function it is to determine the course of the future. He held a cyclic view of human affairs ; and maintained that " an accurate acquaintance with the events of the past would be useful, because, in all probability, the same sort of things would happen again." Polybius (*c.* 204–*c.* 122 B.C.), another Greek historian, who lived in Rome and wrote of the nan Republic, shared the belief of Thucydides in the cyclic revolu- of the polities of man; but he was far more scientific than Thucydides. t is to say, he was cooler, more impartial, less rhetorical, con- ned rather to interpret the present than to control the future. His prime iness was to explain in the light of history how it was that the Roman state had attained a condition of stability and power so incomparably erior to that of the city states of his native land. This business he ieved in a work of massive solidity, comprising both a narrative of the nan conquests and an analysis of the Roman constitution. His work model of judicial impartiality, and is therefore somewhat dull. He held doctrine, later propounded by Dionysius of Halicarnassus (*c.* 15 B.C.) by Viscount Bolingbroke (A.D. 1735), that "history is philosophy hing by examples."

'he native Roman historians were few and late: until the second cen- B.C.—that is, until the publication of Cato's *Origines* (*c.* 160 B.C.)— annals of the Latin city were in Greek, and mainly written by Greeks. first notable work of Latin history was, indeed, the inimitable *lic War* of Julius Cæsar—the great Cæsar, the democratic republican se name became a synonym for autocratic empire, a man of genius ally unapproachable in statesmanship, in generalship, in oratory, and iterature. Yet, though Cæsar's *Gallic War* (51 B.C.) gives a vivid and terly account of seven of the eight campaigns that resulted in adding w province to the Roman Empire and in extending the Latin civilis- n from the Mediterranean to the Atlantic, it is primarily an autobi- phy. With all its impersonality and restraint, it is essentially its author's *logia pro vita sua*. And the same remark bears good respecting its uel, the less accurate and less perfectly constructed *Commentaries on Civil War*, published after Cæsar's death in 44 B.C. Not wholly un- thy to follow the writings of the incomparable Cæsar were the works is contemporary and supporter, Sallust (86–34 B.C.). He wrote of the nts of his own turbulent times in a detailed history of which, un- unately, only a few fragments remain. He also wrote monographs on *Conspiracy of Catiline*, which had taken place under his own eyes, on the *Jugurthine War*, which had been waged two generations before lay. His story of Catiline is a vivid piece of contemporary journalism; account of the struggle of Rome with Jugurtha, however, involved arch which showed Sallust to be a historian of no ordinary perspica- and power. He wrote partly for the pleasure of telling a fine tale y; but partly also, and primarily, for the sake of conveying the moral incompetencies and treacheries such as those that had marked the nidian war, together with depravities and perfidies such as those of h Catiline and his comrades had been guilty, would inevitably and dily entail the ruin of Rome. He wrote with a profound pessimism. saw the state of the republic sinking from bad to worse. And he had hope that either the warnings of his writings, or the vigorous anti- ocratic actions of his friend Julius Cæsar, would stem the descent of city to destruction. A more cheerful, and as it turned out, a more rate view of the Roman fate was taken by Livy, whose career (59 B.C.– 17) formed a bridge linking the Republic to the Empire, and the pre- stian era to the Christian. He—the Treitschke of antiquity—in a style redolent of the Greek rhetoricians, sang the glories of the Roman Commonwealth, told the story of its expansion, and appealed to the pride and ambition of its citizens to maintain and enlarge its boundaries and its might. He saw the evils of his own day, but he had faith that Rome would suppress them, surmount them and survive, as she had so often triumphed over still deadlier calamities in the great times of old. As a historian he was careless in matters of detail ; he gave currency to countless unsubstantial legends ; he settled questions of truth by means of his own predilections : "*in rebus tam antiquis,*" he comfortably said, "*si quæ similia veri sint pro veris accipiantur*" ; necessity, to him, was the mother of invention—he freely composed speeches for his leading characters. A hundred years later than Livy flourished Tacitus, the last and in respect of language the most notable of all the great Roman historians (A.D. 55–*c.* 117). Although the son-in-law of Agricola, the conqueror of Northern Britain, and although himself a consul and a frequenter of the imperial court, he was under no illusion as to the moral decadence of Rome. He depicted in his *Annals*, in lurid and ineffaceable colours, the depravities and the iniquities, the cruelties and the treacheries, of the palaces of Tiberius and Nero. Over against them he set the virtues and the simplicities of the Teutonic barbarians—recently brought into contact with the Empire—who inhabited the forests of *Germania*. Tacitus was unquestionably a moralist rather than a scientific historian. He employed history, as Juvenal employed poetry, as an instrument with which to scourge the profligate degenerates who occupied the high places of State during the central period of his life.

One of the marks of Roman degeneracy which impressed itself upon the attention of Tacitus was the spread of the cult of Christianity. Tacitus, of course, could not understand the new religion, and since it prevailed mainly among slaves and aliens he considered it beneath his pride to examine it. But since he noticed that it led its votaries to decline military service, to withdraw from social life, and to repudiate the ceremonial worship of the emperor, he had no hesitation in pronouncing Christians to be "enemies of the human race." In spite, however, of the contempt of the worldly-wise, and the active hostility of the momentarily-great, the new religion spread until in the fourth century after Christ the emperor himself was constrained to profess conversion, to proclaim himself the protector of the Church, and the bishop of bishops. The conversion of Constantine (A.D. 306–337), and the triumph of the Christian Church over Roman paganism which was completed within the limits of the century, had a profound effect upon historiography. The writing of history passed into the hands of priests and monks, and in their hands it remained throughout the mediæval millennium. This meant that historiography was reduced to the rank of the handmaid of theology ; that it was made, as never before, pragmatic and didactic ; that it lost whatever scientific character it had ever had, and became wholly indifferent both to truth and probability ; that it became filled with miracles and marvels ; that it ceased to regard any values that were not religious ; that it lost all sense of perspective, placing the Hebrews in the forefront of the drama of the ages and relegating all the empires of antiquity to the background or the wings ; that, in short, it blotted true history out of existence for a

ısand years. The impressive unity of the Roman World was broken
Belligerent and culturally-primitive barbarian tribes settled them-
es where once had been established the *civitates* of the Empire. The
ıan peace gave way to the incessant conflicts of inter-tribal war.
lisation, almost exterminated throughout the West, maintained such
as it was able to preserve, in monasteries and churches. Here history
sort continued to be studied and written. For example, the *Chronicles*
fricanus (A.D. 221), Eusebius (*c.* A.D. 340), and Jerome (*c.* A.D. 400)
ided a rigid framework of fictitious chronology from which (as over-
ed and renovated by Scaliger in 1583 and by Usher in 1650) history
hardly even yet been able to emancipate itself. The *Septem Libri
oriarum adversus Paganos* of Paulus Orosius, a mass of tendentious
, maintained itself as the standard authority on secular history from
fifth century to the fifteenth, when it was consigned to the rubbish-
by the destructive criticism of Flavius Blondus.

ut if patristic historiography was fatal to the science of history, it was
ay of compensation the creator of the philosophy of history. Fantastic
ere the illusions of the early Christian Fathers respecting the actual
se of terrestrial affairs, they certainly succeeded in viewing the pro-
of history steadily and in viewing it as a whole. They perceived in
rogress of humanity from the Garden of Eden to the New Jerusalem,
ay of the Fall of Adam and the Redemption effected by Christ, a
y perfect in its dramatic integrity. They thus emancipated history
local and temporal limitations, and gave it an unprecedented dig-
as the record of God's dealings with Man. The *Ecclesiastical History
usebius* (A.D. 324) was a work of a new type : it was the first attempt
rite a history of civilisation. St. Augustine's *Civitas Dei* (A.D. 426),
of the outstanding books of the world's literature, may similarly be
rded as the first attempt to frame a complete philosophy of history.
as, however, a singularly unsuccessful attempt ; for it contained
er philosophy nor history, but merely theology and fiction. Never-
ss, it was a sublime effort of the sanctified imagination. In order to
t the charge that the capture of Rome by the Goths in 410 was due
e abandonment by the Romans of the old gods under whose tutelage
ity had become great, Augustine surveyed the whole course of affairs,
an and divine, from the casting of Satan out of heaven to the final
of Judgment. All that he says about the *Civitas Diaboli*—that is about
four successive pagan empires of the Assyrians, Persians, Mace-
ans, and Romans—is a mere travesty of fact, a farrago of nonsense.
his pseudo-philosophy reduces mankind to the condition of mere
ets—helpless pawns in the frightful game played on the board of
ity during the æons of eternity between God and the Devil. Neverthe-
Augustine's conception, both of history and of philosophy, remained
nant throughout the thousand years of the middle ages, a nightmare
sion.

e middle ages, thus auspiciously inaugurated, got all the general
ar history they seemed to need from Augustine and Orosius, and all
cclesiastical history considered good for them from Eusebius and
ontinuators, Socrates, Sozomen, Theodoret, and Cassiodorus. The
al contributions which the middle ages made to historiography

were of a very different order. They consisted primarily of annals and of chronicles. The *annals*—closely akin to those which had characterised the dawn of civilisation in Egypt and Babylonia—were mere jottings of contemporary events made in the margins of the chronological tables by means of which the date of Easter was determined. Many of the events mentioned, especially in the earlier annals, were of the most trivial description, *e.g.*, earthquakes, miracles, the transfer of sacred relics, the birth of six-legged pigs, and so on. Gradually, however, the quality of the entries improved, until in the later middle ages such annals as those of Roger of Hoveden, or the *Greater Annals of Cologne*, became valuable records of historical happenings. The *chronicles* attempted a larger survey. Keeping the annalistic form, they professed to summarise the history of the world from the creation to the date of writing. For the earlier section of their chronology they were usually content to transcribe the fabulous fabrications of Eusebius. For the later section, however, dealing with their own days, they drew upon more authentic sources of information, and gradually they became works to which the name of history might not inappropriately be assigned. Among the many notable and invaluable chronicles of the closing period of the middle ages the following may be mentioned as typical; the *Chronicle of Nantes* in France (to A.D. 1049); the *Anglo-Saxon Chronicle* (to A.D. 1154); the *Chronicle* of Otto of Freising in Germany (to A.D. 1158), and the *Greater Chronicle* of Matthew Paris in England (to A.D. 1255). In the fourteenth and fifteenth centuries the annalistic form began to be dropped, the number of recorded miracles and marvels tended to diminish, the style of consecutive narrative commenced to prevail. Works of the new type were well represented by the famous and delightful *Chronicles* of Froissart (A.D. 1337–1410), and by the not less attractive and far more scholarly *Memoirs* of Philippe de Commines (A.D. 1445–1509).

It is probable that the improvement characteristic of the later mediæval chronicles was due in no small degree to the influence of the Arabic civilisation of the contemporary Muhammadan world. Christianity and Islam came into contact with one another in the Holy Land and its vicinity, in Sicily and South Italy, and in the Spanish Peninsula. This contact was by no means wholly, or even mainly, a hostile one. Just as Balaam came to curse Israel and remained to bless, so did the Crusaders set out to fight Islam and remain to sit at its feet and learn. For the semi-barbaric warriors of the Cross found to their amazement that the infidels, although theologically in a state of reprobation, were possessed of a terrestrial civilisation incomparably superior to their own. For example, in the sphere of historiography, with which alone we are here concerned, Masoudi of Arabia (A.D. ?–956), in his *Ketab-al-Adjayb*, had surveyed with masterly ability both the history and the ethnography of Western Asia, Northern Africa, and Eastern Europe; Ibn-Khallikan of Damascus (A.D. 1211–1282) compiled a dictionary of historical biography not unworthy to be compared with the classical *Parallel Lives* of Plutarch,

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[1] So excellent both in form and substance was Ibn-Khallikan's book that, six hundred years after its first appearance, it was thought worthy of translation into English: *cf.* M. Slane, *Ibn-Khallikan's Biographical Dictionary*, 4 vols (1842–1871).

, above all, Ibn-Khaldun of Tunis (A.D. 1332–1406) wrote, *inter alia*, a *legomena to Universal History* so remarkable in the sweep of its in- mation, the sanity of its outlook, and the profundity of its philosophy, as ustify Professor Flint in speaking of the great Tunisian scholar as "the nder of the science of history."[1]

he influence of this Arabic culture, which reached Christian Europe nly through the universities of Southern Italy and of Spain, was among potent causes that brought the middle ages to an end, and ushered in dawn of modern times. Among other influences tending in the same ction were those that came from the Far East by way of the trade tes opened up by the conquests of Jenghis Khan (A.D. 1162–1227) and successors. These included the art of printing, which brought the ical monopoly of knowledge to an end; the use of the mariner's com- , which made the great voyages of discovery possible; and the inven- of gunpowder, which revolutionised the art of war, and so terminated military ascendancy of the feudal chivalry. The century A.D. 1450– was the great age of transition.

III

he renaissance of humanism, which was one of the most striking ures of the age of transition from the mediæval to the modern times, essentially a revolt of the long-suppressed paganism of Italy against domination of the Church. It was in some respects a reactionary and ogressive movement. It meant a return to the study of moribund uages, a resurrection of defunct and obsolete classics, a revival of astic philosophies, and above all, a descent to moral and social dards deplorably lower than those attained during the ages of faith. bably, however, it was a necessary stage in the emancipation of the stern intellect from the ecclesiastical fetters in which it had been (for ood) held fast for a thousand years. What but the power of Plato d have broken the spell of Aquinas? Who save Julius Cæsar could shaken the authority of Hildebrand? What lesser influence than of Cicero could have challenged the ascendancy of Augustine?

the sphere of historiography the humanistic revival meant the larisation of history, the transference of the task of recording the se of affairs of state from clerics to laymen, the suspension of chron- of all sorts and the substitution of writings of a very different acter—writings in which the spasmodic workings of divine provi- e and the frequent interventions of the saints gave place to the matic machinations of diplomatists and the intermittent arbitra- ts of the sword. It meant, in the second place, an excessive dispar- ent of the middle ages, as though they had been nothing but a d of suppressed liberty and vile Latinity; and, as a counterpart, an ssive adulation of the ages of classical antiquity, as though they had essed the attainment of all that the mind of man could desire. It t, thirdly, a vast improvement in the style of literary composition, ification of the Latin vocabulary, an imitation of the best models of the Augustan epoch—an imitation which, however, sometimes became so slavish as to render the writer, in his rhetorical efforts, unable to say a plain thing plainly, or even to convey any intelligible meaning whatsoever. It meant, fourthly, a revival of the pagan and pessimistic idea of cyclic movements in history (as opposed to the idea of the single progressive movement from the earthly to the heavenly paradise) ; to a recrudescence of the pre-Christian conceptions of capricious fortune and inexorable fate ; and to a return to that individualism and emphasis on personality that had been so conspicuous a feature of the writings of such old historians as Thucydides and Plutarch. Finally, however, and above all, it meant the advent of a new critical spirit—a return in a novel guise of the old Greek passion of insatiable curiosity and unfettered enquiry. A tremendous sensation was caused in ecclesiastical circles when Lorenzo Valla (*c.* 1406–1457) demonstrated beyond possibility of dispute that the so-called *Donation of Constantine*—one of the central pillars of the temporal power of the papacy—was a clumsy forgery concocted in Rome nearly five centuries later than the date which it purported to carry. Less sensational, but even more remarkable as displays of his critical capacity, were his disquieting dissertations on the text of the Vulgate, and his destructive essays on the early decades of Livy.

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[1] For an admirable account of Ibn-Khaldun and his work see R. Flint, *ry of the Philosophy of History* (1893), pp. 157-171.

Leading exemplars of the new humanistic historiography in Italy were, beside Lorenzo Valla, (1) Leonardo Bruni (1369–1444), whose *History of Florence in Twelve Books* was the first considerable work to display all the leading characteristics of the new school—its secularity, its classicism, its rationalism, its individualism ; (2) Poggio Bracciolini (1380–1459), secretary to seven successive popes, whose *Eight Books of the History of the People of Florence* provided a conspicuous example of the way in which devotion to Latin style could obscure Italian sense ; (3) Flavio Biondi, better known as Flavius Blondus (1388–1463), the greatest of all the humanistic scholars of his age, who wrote numerous works on Roman antiquities, and in addition thirty-one books of a history of Christendom since the fall of the Roman Empire, which served as the basis of all subsequent study of the subject ; (4) Æneas Sylvius Piccolomini, Pope Pius II (1405–1464), who brought a unique knowledge of politics and the experience of extensive travel to aid him in his delineations of Germany under Frederick III, and of Bohemia during the Hussite wars. But eminent and typical beyond all these were the two great and wholly emancipated Florentines (5) Niccolo Machiavelli (1469–1527) and (6) Francesco Guicciardini (1483–1540), who in the completeness of their paganism, their contempt for the middle ages, their hatred of the papacy, their absorption in politics, their devotion to their country, and their skill as narrators, marked the apex of humanistic historiography.

Outside Italy the humanistic movement gradually spread, and before the middle of the sixteenth century most of the countries of Northern Europe had seen the rise of historiographers of the new order, whether nominally orthodox like Piccolomini, or frankly pagan like Machiavelli. Here and now it must suffice to mention a few representative names Among the earliest and best was Polydore Vergil (1470–1535), an Italian ecclesiastic who settled in England and there wrote a *History of England in the Reign of Henry VII* that served as a model for all subsequen oriographers in this country. Next in order of time came Joachim von tt—commonly known as Vadianus—in Switzerland (1484–1551). He layed in his *Grosse Chronik der Aebte von Sankt-Gallen* a critical mand of his sources, a philosophical insight, and a power of literary sentation, that placed him high among the historians of his time. nost exactly contemporary with Vadianus was the German Beatus nanus (1486–1547), who applied to the sources of early Teutonic ory the same canons of critical exegesis as his friend Erasmus was lying to the study of New Testament texts and ecclesiastical records. n to Spain the humanistic tide extended, and Diego de Mendoza 3–1575), the historian of the Castillian conquest of Granada, showed , with all his piety, he had learned from the Italians both how to cross-mine his authorities and how to write. In Scotland humanism was thily represented by the learned George Buchanan (1506–1582). He a marvellous command of the purest Latin, and he could tell a story unexcelled clarity and vigour. His critical powers, however, were equal to his literary capacity and he embodied in his *Rerum Scoti-m Historia* masses of legendary and miraculous rubbish. Humanism hed France curiously late. Not until Joseph Scaliger (1540–1609) in *De Emendatione Temporum* tried to harmonise the Eusebian chrono- with the proved facts of secular history did a genuine humanistic olar appear in the Valois kingdom—and Scaliger's later associations e with the Netherlands rather than with France. When he was a pro-or at Leyden he had among his pupils the portentous Hugo Grotius 3–1645), in whom the humanistic renaissance in the Low Countries luced its finest flower.

ut humanists like Buchanan, Scaliger, and Grotius were men of a different type from the pagan classicists of Italy. They were men of Reformation rather than of the Renaissance; Christians of a new and nge sort rather than Neo-Platonists; Hebraists or even Philistines er than Hellenists or Ciceronians. The Italian humanists in their ch for classical texts had discovered the Greek New Testament, and study of this unfamiliar and revolutionary document revealed not the fact that the Latin Vulgate contained some very bad perversions he doctrines of Christ and the Apostles, but also the fact that the holic Church under the fifteenth century popes was a remarkably rent institution from the Christian Church of the first century evan-ts. The Italian scholars made the discovery, shrugged their shoulders, went their way. It did not interest them. The Greek of the New ament was so different from the Greek of the age of Pericles that they d lest any careful study of it should spoil their style: even Cardinal bo warned his friends against reading the epistles of St. Paul! North e Alps, however, the result was different. To the sober and serious lars of Germany, Switzerland, and the Low Countries, the content, he language, of the Greek New Testament—and of the Hebrew Old ament, the study of which soon followed—was of prime significance. e in these regions, instead of a movement of return to classical uity, there was a movement of return to primitive Christianity. movement was strongly aided by the desire of the northern peoples mancipate themselves from the Latin yoke, and to escape the enormous and growing exactions of the papal court. This combined movement—moral and intellectual on the one hand, racial and political on th other—came to a head in Germany in A.D. 1517, when Martin Luther an Augustinian monk and a professor at the university of Wittenberg proclaimed anew the Pauline doctrine of justification by faith, and challenged the whole papal system of sacraments, priestly absolutions, penances, and indulgences.

This is no place in which to recount the story of the great Reformatio struggle, or to retell the horrible tale of the so-called Wars of Religion Enough for us to note that, as the result of this struggle and these wars Christendom was rent in irremediable schism, and that controversy rage with a ferocity unknown since the remote centuries when Paganism an Christianity contended for the soul of Rome. Now Christianity—like it predecessor Judaism and its offshoot Muhammadanism, but unlike mos of the other great faiths of the world—is a historic religion. That is to say it asserts as its fundamental dogmas the verity of certain cardinal event alleged to have transpired in time and space. And not only is it histori in its foundations, it has also spread and developed by a historic o evolutionary process. Hence the controversy between Luther and th Pope, between Protestants and Catholics, and between the numerou sects that rapidly arose in the disintegrated Church, became a controversy in which history was called upon to provide some of the most formidable missiles and some of the highest explosives. An immense impetu was thereby given to historical research. The research was, of course, o an extremely impure kind. It was undertaken, on both sides, not in th interests of scientific truth, but in the interests of party propaganda Nevertheless, just as religious toleration was the unintended but inevitable consequence of the indecisive Catholic-Protestant wars, so was historic truth the indirect product of the clash of the rival Catholic-Protestan propagandas. Never before had there been such a rummaging in the dust heaps of forgotten ecclesiastical history ; never before had the methods o historical investigation been developed to so high a degree of efficiency From the blows of Protestant steel upon the flint of Catholic immobilit the spark of historical verity was somehow struck.

Robert Barnes's *Vitæ Romanorum Pontificum* (1536) and John Foxe' *Book of Martyrs* (1554) were but preliminary biographical skirmishes The attack of the main Protestant army upon the Catholic citadel wa delivered by means of the famous *Magdeburg Centuries*, first published a Basel, under the title *Historia Ecclesiæ Christi*, during the years 1559 1574. This great work surveyed, century by century (whence the title b which it was popularly known, and under which it was actually publishe from 1757 onward), the history of the Christian Church from its foundation to the year A.D. 1400. Treating the Church as depicted in the Acts o the Apostles as the divinely ordained standard of organisation and doctrine, it depicted the ecclesiastical history of the succeeding fourtee centuries as the story of a rapid and continuous corruption and declin It administered a wholesome shock to a complacent Christendom, and provided a mass of authentic information respecting Councils and pope that required a lot of explaining away. The Magdeburg Centuriators—Matthias Vlacich (Flacius) of Magdeburg and his collaborators—initiate modern rationalistic study of ecclesiastical history. The challenge of *Centuries* of Magdeburg called forth the answering *Years* of the linal Cæsar Baronius. Baronius was director of the Vatican library, so he had full access to the unparalleled collection of mediæval docu- ts which that vast storehouse of historic material contained, and still ains. It had never before been drawn upon for historiographical pur- s, and accordingly Baronius was able to lay before the learned world es of new information which conclusively refuted many of the tions of the Centuriators. Nevertheless, Baronius over-reached him- and did serious harm to his cause, by his excessive economy of truth by his wholly unscrupulous method of controversy. His *Annales siastici* were published in Rome during the years 1588–1607. Their erous errors, their flagrant *suppressio veri*, and their unwarranted *stio falsi*, made them an easy prey to the searching and remorseless cisms of the great Protestant humanists, J. J. Scaliger and Isaac ubon. And so the great controversy went on.

her influences, however, beside theology, in the sixteenth and seven- h centuries, were stimulating the study of history. First and fore- of these were the influences which flowed from the regions opened y the great voyages of exploration and discovery that were the out- ling features of that era. The Christian civilisation of Europe was ght into contact in Mexico and Peru, in Borneo and the Spice ds, in South Africa and the archipelagos of the Pacific, with civilisa- or barbarisms wholly alien from those of the Mediterranean world, et venerable with an immemorial antiquity, and fascinating with the ction of curious novelty. The historic imagination was quickened; the of historical enquiry was widened; investigation into customs, ers, beliefs, modes of political and social organisation, took the of the monotonous annals and chronicles of the stagnant middle The earliest writers of this new order of social historians were ly, as was natural, Spaniards. Eminent among these were Gonzalo viedo (1478–1557), Bartolomé de Las Casas (1474–1566), Francisco omara (1512–*c.* 1570), and Antonio de Herrera (1549–1625). A d influence, closely associated with this first, was the change in the mic organisation of Christendom caused by the opening up of the World. Colonisation, overseas commerce, capitalism, unregulated try, de-feudalised agriculture, produced a social upheaval that set ers of the unhappy and disturbed proletariat to enquire into the and justification of the systems of law and government by which were inconvenienced. In England, for example, the Norman Con- got the unenviable reputation of having been the cause of most of bes that afflicted the seventeenth century peasantry. Agitators, there- ike Everard and Winstanley made it their business to enquire more what precisely the Norman Conquest was.

more important than either geographical discovery or social transi- s a cause of historical activity were the constitutional conflicts that d the century A.D. 1550–1650. Three of these were of supreme cance. One was the struggle of the Dutch Netherlands to maintain ancient rights of self-government and provincial autonomy against croaching centralisation of Philip of Spain. The controversy which preceded the War of Independence necessitated profound research int the archives of Burgundian and even Carolingian times. Another crucia conflict that turned on historic issues was that between the French Kin and his feudal nobility. A number of works, half-legal, half-historical—o which Hotman's *Franco-Gallia* (1574) is among the best known—expose the Capetian origins of the French monarchy, and maintained the caus of constitutional government. But greater and more far-reaching in its consequences than either of these conflicts was the mortal struggle that brok out in the early seventeenth century between the Stuart kings of Englan and their parliaments. Each side appealed to precedents. The kings contended that they were claiming no prerogatives that had not been possessed without dispute and exercised without opposition by Elizabet and Henry VIII. The parliaments on their side maintained that they wer claiming no privileges and asserting no rights that had not been full admitted and allowed by Henry VI. Antiquaries on both sides were se to work to ferret out old charters, examine obsolete statutes, and colle relevant precedents. The king's researchers, and in particular Noy, hi attorney-general, were extremely successful in finding information concerning the countless pettifogging and irritating ways in which mediæva monarchs had raised money from their reluctant subjects. On the othe side, the great parliamentary lawyers—Coke, Selden, Spelman, St. Joh and the rest—made permanent contributions to English constitutiona historiography, as well as to English constitutional development, by revealing the foundation on which the liberties of the subject were base The controversy between Charles I and John Hampden was almost rich in its influence upon the development of the study of history in Eng land as was the controversy between Leo X and Luther in its influenc upon the development of the study in Germany. And once again, whe the tumult of the battle had died down, it was found that in the spac between the exhausted combatants, but subject to neither of them, hi toric truth at length stood free.

The tumult of religious and political conflict, however, was long dying down in Europe. Not till the eighteenth century was well advanc did scepticism in matters theological, and stagnation in matters politica allow sufficient tranquillity of soul for history to re-assert itself as a scien and not a weapon of war. The first clear voice that sounded in the eig teenth century, recalling history from the battlefield into the study, can from the remarkable Giovanni Battista Vico (1668–1744), whose gre work *Principii d'una Scienza Nuova* appeared in 1725. In this semin dissertation history takes its place as part of a comprehensive science human society, the method of its study along strictly logical lines is considered, each epoch (including the much-maligned middle age) is viewe as having its proper place in an evolutionary scheme; the course of histo is treated as at once cyclic and progressive, and the general idea of a pr vidential plan is inferred. As a contribution to the philosophy of histo Vico's *Scienza Nuova* stands in the front rank of eighteenth century wri ings. The actual study of history along rational and scientific lines, hov ever, lay outside the sphere of Vico's labours : he was primarily a juris The task of applying his principles he had to leave to others. And amo the first and most eminent of these was Montesquieu (1689–1755). H

Montesquieu was a disciple and conscious follower of Vico is a matter
nuch dispute. He had a copy of the *Scienza Nuova* in his library, but
e is no direct evidence that he had ever read it. But if he had not, then
most remarkable manner he exemplified its precepts in the wide
veys of history and politics which he made in his *Lettres Persanes*, his
tise on *La Grandeur et la Décadence des Romains*, and his *Esprit des*
. In these works, with the calm detachment of a naturalist, he ex-
ned and compared the constitutional development and the existing
litions of the English and the French, contrasting them with those of
Romans and of other peoples of recorded antiquity. He made a valu-
and enduring contribution to a science of society by emphasising the
tion of climate to institutions and ideas. More destructive in his
tical criticism and in his frank irreverence was François Marie
uet, commonly known as Voltaire (1694–1778). His *Histoire de*
rles XII (1731) was a brilliant and illuminating survey of the meteoric
er of the Swedish warrior-King; his *Siècle de Louis XIV* (1751),
ndoning strict chronology, made a penetrating analysis of the elements
rength and of weakness in the France of *le roi soleil*; his *Essai sur les*
urs (1756), the first serious attempt to write a universal culture-
ory, was notable for its recognition of the debt of Christian civilisation
e Arabs, for its treatment of social and economic as well as political and
ious affairs, and for its total repudiation of all those supernatural ex-
ations of events which had dominated historiography from the days of
sius to his own. Something of the rationalistic and comprehensive
t of Voltaire manifested itself in the historical writings of David
e (1711–1776), William Robertson (1721–1793), Michael Schmidt
6–1794), Edward Gibbon (1737–1794), and Arnold Heeren (1760–
). All of these agreed more or less with Bolingbroke in regarding his-
as philosophy teaching by example; but, since they had discarded
pletely the philosophy of history which had prevailed from Augus-
to Bossuet, they were by no means sure either what history was in-
ed to teach, or what as a matter of fact it taught. In the matter of
od, too, although they were feeling their way towards a critical ex-
ation of original sources, they were all disposed to begin their writ-
before they had acquired a sufficiently complete control of their
orities. Only gradually, moreover—with the notable exception of
en, who in this respect was a pioneer—did they extend the scope of
enquiries beyond the restricted sphere of politics and religion.

hile this distinguished band of rationalistic historians was at work,
French Revolution broke out (1789). It stemmed and diverted the
nt of historiography, as of most other things. At the time of its out-
a number of young historians were at work, especially in Germany,
ucing writings, often brilliant in style, under the sentimental and
ersive influence of Rousseau. They clearly displayed the beginning
eaction against the arid rationalism of Voltaire and his school. Such
Johann Herder, whose *Reflections on the Philosophy of the History*
umanity appeared during the years 1784–1791; Johannes Müller,
e enthusiastic *History of the Swiss Confederation* began to be pub-
in 1786; Friedrich Schiller, whose highly poetical account of the
y Years' War was issued in 1791; and Friedrich Schlosser, who

attempted, but failed to complete, a gigantic *Weltgeschichte* during the opening years of the nineteenth century. The great quarter-century of the Revolution and the Revolutionary Wars (1789–1815) was, however, not favourable to historical research or historiographical composition. History was being made at too fast a rate to allow of reflection; passions were running too high to permit of abstraction; changes of ideas were occurring too frequently to warrant dogmatism.

When once again Europe settled down, after the Congress of Vienna (1815), to a peace of exhaustion, it was found that an intense reaction against Rousseau and the Revolution had taken place. In the sphere of philosophy no better example can be found than J. G. Fichte (1762–1814). His *Considerations on the French Revolution* (1793) and his *Foundations of the Rights of Nature* (1796) are instinct with the individualism, the cosmopolitanism, and the egalitarianism of the *Social Contract*. On the other hand, his *Closed Commercial State* (1800) and his *Theory of Politics* (1813) show an entire abandonment of Rousseau, and a whole-hearted conversion to the principles of reaction, collectivism, and nationalism. No historian lived to make so complete a *volte-face*, unless we include among historians the Englishmen Robert Southey, William Wordsworth, Samuel Taylor Coleridge, and James Macintosh. Before 1815 Herder (1803), Schiller (1805) and Müller (1809) were dead. And the new race of historiographers was in the grip of a portentous Romantic Reaction.

This Romantic Reaction was one of the most curious of the aftermaths of the revolutionary era. It marked a violent revolt both against the sceptical rationalism of Voltaire and the French Encyclopedists, which had undermined the Bourbon monarchy and the Gallican Church, and also against the abstract philosophy of Rousseau and Kant, which had repudiated all the lessons of history and had encouraged reckless innovators to try to reconstruct human society on entirely new foundations. The outstanding features of the reaction were devotion to irrational religion, reverence for antiquity merely as such, obedience to tradition and custom, idealisation and glorification of the middle ages, revival of the dogma of divine right, exaltation of the principle of nationality, opposition to the idea of democracy. Once again, in the hands of the romantics, historiography became didactic and pragmatical. The cult of chivalry was revived, and highly over-coloured pictures of the glories and graces of mediæval knighthood were presented in such works as Perrot's *Collection Historique* (1820), Digby's *Broad Stone of Honour* (1822), Büsching's *Ritterzeit und Ritterwesen* (1823), and James's *History of Chivalry* (1830). The imperfections of the mediæval Church were glozed over, and the attractive features of the ages of faith portrayed in glowing colours in countless works, of which Chateaubriand's *Génie du Christianisme* (1802) was the most notable and influential. Thierry's *Norman Conquest* (1825), Barante's *Dukes of Burgundy* (1826), Michelet's brilliant *History of France* (1833 et seq.), Carlyle's *Past and Present* (1843), all illustrate the way in which the minds of men had been turned from the contemplation of the horrid actual to that of the vanished ideal, the visionary and largely fictitious " old perfections of the earth." And the same might almost be said of such solid contributions to learning as Eichorn's *Deutsche Staats- und Rechtsgeschichte* (1808–1823). The one real service, indeed, which nanticism rendered to historiography was to rehabilitate the middle s ; to remove the stigma placed upon them by the men of the Renais- ce, Reformation, and *Aufklärung* (or Age of Enlightenment) ; to turn olars to the study of their long-neglected records. But, all the same, spirit of Romanticism was wrong ; it refused to allow the dead to bury lead. The worst excesses of its embalming genius were displayed in so-called philosophies of history of Schlegel, Schelling, and Hegel.

IV

'he foregoing rapid and necessarily superficial survey of historio- ohy from the earliest times down to the beginning of the nineteenth tury will have made it clear that at no time had the study of history n to the standard of accuracy, impartiality, and comprehensiveness ianded of a science. The nearest approach to a scientific treatment of records of the past had been seen in the works of Thucydides and ybius in ancient days ; Ibn-Khallikan and Ibn-Khaldun during the dle ages ; Machiavelli and Guicciardini in early modern times ; and lly, the writers of the eighteenth century *Aufklärung*. But all of them , from the scientific point of view, been less than perfect. The pur- e of both Thucydides and Polybius in writing history had been dis- tly political ; that of the mediæval Arabs religious ; that of the Renais- ce Florentines patriotic and nationalist. As to the eighteenth century oriographers, from Voltaire to Gibbon, if they had to some extent ncipated themselves from enthusiasm for any causes human or divine, had not succeeded in emancipating themselves from prejudices ch perverted all their work. They were, also, in the main so careless ecting both accuracy of detail and completeness of information that r writings belonged rather to the category of imaginative fiction than hat of scientific history. Not without justification did Sir Robert pole remark : " History is not worth studying, for we know that it t be false." The persistence with which flagrant, if picturesque, rs were transmitted from author to author, world without end, gave it to the observation that, if history did not repeat itself, historians oubtedly did repeat one another.

'hile, however, the renascent neo-pagans were reviving the cult of ical antiquity ; while the reformers were disinterring primitive istianity ; while the rationalists were returning to nature, and the antics to the middle ages—throughout the seventeenth and eighteenth uries a slow work was going on, inconspicuously and laboriously, that e the development of a science of history possible in the nineteenth ury. This work was the collection and the editing of sources. The task ollecting was at first performed but perfunctorily and spasmodically ; craft of editing had to be learned by means of many lamentable res. But gradually the necessary technical skill was acquired, and as ult a corpus of authoritative original material was steadily accumu- l. Here it must suffice to mention a few of the outstanding achieve- ts of pre-nineteenth century scholarship. They were largely the out- e of the new sense of nationality, and of the novel passion of patrio- , that were stimulated by the struggles of the Reformation period.

England led the way with its collection of chronicles, of which the mos famous were Hall's (1547) and Holinshed's (1586) (source of the majorit of Shakespeare's historical plays). Spain followed suit with Robert Beal' *Rerum Hispanicarum Scriptores* (1578–1581). Then came Germany, wit Melchior Goldast's monumental *Monarchia Romani Imperii* (1611–1614) closely followed by France, where André Duchesne edited first the *His toriæ Normannorum Scriptores* (1619) and then the *Historiæ Francorun Scriptores* (1636 et seq.). More important, however, than any of thes merely national collections were the volumes of mediæval chronicle which from the middle of the seventeenth century began to be prepare and published by the scholarly Benedictine monks of the congregation o St. Maur in Paris. Particularly notable was the work of the great Jea Mabillon (1632–1707), whose treatise *De Re Diplomatica* (1681) initiate the scientific investigation of manuscripts, and made the satisfactor editing of mediæval documents possible. Almost exactly contempor aneous with the productions of the congregation of St. Maur were th *Acta Sanctorum* commenced in 1643 by Jean Bolland. In this immens series, continued for two-and-a-half centuries, all (and frequently mor than all) that is known of the lives and works of the saints is told for th edification of the Church and the delectation of the world. In 1663 th powerful French minister Colbert founded the Académie des Inscrip tions et Belles Lettres which began the publication, *inter alia*, of th *Ordonnances des Rois de France*.

The eighteenth century saw the initiation of other important series o publications. Notable among them were the twenty-five volumes o Muratori's admirably selected and edited *Rerum Italicarum Scriptore* (1723–1750), and Bouquet's twenty-three volumed *Recueil des His toriens des Gaules et de la France* (1738 et seq.). England was much behin other European countries in its care of its ancient documents. True, th Government paid Thomas Rymer to prepare his *Fœdera* (1704–1735) bu it did not appoint a Record Commission to enquire into the nature an distribution of its muniments as a whole until 1800. Meanwhile, howeve private enterprise and enthusiasm had to some extent prepared the way William Dugdale's *Monasticon* (1655–1673); Thomas Madox's *Excheque* (1711); Edmund Gibson's *Codex Juris Ecclesiastici* (1713); Thoma Hearne's *Chronicles* (1716–1735); David Wilkin's *Concilia Magn Britanniæ* (1737), and Farley's *Domesday Book* (1783) were among th works that had done something to remove the reproach of negligence an incompetence from English antiquarian scholarship, and to make goo the lack of public activity.

Speaking generally, we may say that at the beginning of the nineteent century the Western world was ripe for the institution of a scientifi school of historians. The growing republic of letters, imbued with th new critical spirit which the study of nature had engendered, was tired o fiction dressed up to look like fact, of propaganda masquerading as trut and of anecdotes professing to exemplify philosophy. The defects of th historiography of the period were conspicuously three, namely, first, a improper aim; secondly, an inadequate conception; and, thirdly, an in effective method. *First, the aim was wrong*. History was rarely studied fo its own sake, that is for the mere purpose of getting at the truth respectin

causes, the course, and the consequences of the great movements
e past. It was studied, or exploited, in order to buttress some ex-
ous political or religious interest. Not even Voltaire could refrain
using his learning for the discomfiture of the clergy; not even
hilosophical Hume could prevent his *History of England* from becom-
a prolonged Tory pamphlet. Thomas Carlyle's American friend,
7. Emerson, went so far as to say of the English that even "the his-
of Rome and Greece when written by their scholars degenerated
English party pamphlets," and the stricture was justified by the pro-
ced anti-democratic bias of Mitford, and the equally marked republi-
m of Grote. The conservatism of Allison was as conspicuous as later
the Whiggism of Macaulay. *Secondly, the conception was inadequate.*
ory was at once too local, too sectional, too personal, and too superfi-
It was too local, in that it tended to limit itself to separate coun-
or even separate provinces, taking no purview of Europe as a whole,
less of the other Continents; it was too sectional, in that it rarely
ed outside the restricted spheres of religion and politics, ignoring
frequently far more important movements that were transpiring in
pheres of economics and society, to say nothing of science and art;
s too personal, in that it concentrated its attention excessively on
and queens, ministers and warriors, great men generally, passing
as too insignificant for notice the condition of the masses of the
le on whose behalf these mighty potentates were supposed to legis-
nd fight, and by whose labour the state of the world was main-
d; it was too superficial, in that it commonly failed to penetrate
ath the surface of anecdote and narrative to the ideas, the emo-
, the acts of will which were the driving forces behind the great
ements recorded. *Finally, the method was ineffective and insufficient.*
much was taken on trust. Inadequate care was given to the collecting
ginal sources. Such sources as lay to hand were not sufficiently cross-
ined and criticised, so as to separate true from false. The whole
of the historiography was unsound and subject to suspicion.

e institution of the new critical school of historiography dates from
ublication of C. F. A. Wolf's *Prolegomena to Homer* in 1795. This
of course, a literary and philological, not a historical work: it showed
for supposing that the Iliad and the Odyssey were written not by
er, or even (as Lewis Carroll contended) "by another person of the
name," but by syndicates who carried on their poetical operations
extended periods of time. Its importance for history lay in the
nstration that information of a vitally significant kind could be ex-
ed from ancient documents by the mere process of studying them at-
ely with the eyes open. It re-inforced what Lorenzo Valla had said
hundred years before, and what Mabillon had iterated in the seven-
h century. The sensation caused in the world of scholarship by
's revolutionary treatise, led his pupil August Böckh to apply the
er's method to historical materials. He did so tentatively, with in-
ing, though not startling, results in his *Public Economy in Athens*
). Incomparably more important, however, than Wolf's influence on
h was his influence on B. G. Niebuhr, the historian of early Rome.
red by the zeal of the new criticism, Niebuhr applied Wolf's method

to an intensive examination of the text of Livy and the other sources o
the legendary history of the Roman republic. Under his disintegratin
analysis the fiction which had filled the pages of even such sceptica
writers as Machiavelli and Montesquieu vanished into thin air, leavin
only a small residuum of solid and almost unrecognisable fact. Dr. G. P
Gooch well says of Niebuhr that "he made Roman history a livin
study, and won for history itself the position of an independent science o
the first rank." The critical way thus marked out by Wolf and pursue
by Niebuhr was further followed as the nineteenth century progresse
by countless scholars in all countries. The names of only a few of out
standing eminence can here be mentioned. Germany, the home of th
new historiography, saw the majority of its earliest and most eminen
exemplars. Easily at their head stood Leopold von Ranke, of whom Dr
Gooch remarks that "he was beyond comparison the greatest historica
writer of modern times," and that "no one ever approached so closely t
the ideal historian." He was conspicuous for his impartiality and imper
sonality of judgment: he made it his supreme concern to discover pre
cisely what had happened, and how it had taken place—*wie es eigentlic
gewesen ist*. He lived a long life, he laboured hard, and he touched man
themes—Italy, Turkey, Spain, Serbia, the Papacy, the Reformation
France, seventeenth century England, etc., etc. At the age of eighty-fiv
—although unable either to write or to read—he dictated a *Weltgeschicht*
or Universal History, seven volumes of which (taking the story to th
twelfth century A.D.) had been completed before he died at the age o
ninety-one in 1886. His work was carried on by a noble band of pupils
among whom Waitz, Giesebrecht, and Sybel were the most conspicuous
In the sphere of Roman studies Niebuhr's mantle fell upon the abl
Theodor Mommsen (1817–1903), of whom more anon.

In France the advent of the new critical method was heralded by th
foundation of the *Ecole des Chartes* in 1821. Although for a few years i
languished, so that it had to be virtually refounded in 1829, before th
middle of the century it had definitely established itself as the main centr
of palæographical and diplomatic studies in Europe. Among the foremos
of its early *alumni* were Benjamin Guérard (1797–1854), Louis Quichera
(1814–1882), and Léopold Delisle (1826–1910), whose works on variou
aspects of the mediæval history of France set a high standard of exact an
penetrating scholarship. The fine example set by these pioneers was followed by a growing band of able followers, among whom Gabriel Monod
Auguste Molinier, Arthur Giry, Julian Havet, Fustel de Coulanges
Paul Viollet, and Achille Luchaire, may be singled out for special mention

From France and Germany the infection of accuracy spread to England. But even before the Continental influence reached this country, th
native conscience had begun to work. Henry Hallam (1777–1859) woul
now be called an amateur; but he brought a vast learning, an indefatigable industry, a lofty impartiality, and a style of truly Teutonic heaviness, to the task of expounding *The State of Europe during the Middl
Ages* (1818), and *The Constitutional History of England* (1827). Mor
obviously guided by German models were Sir Francis Palgrave (1788–
1861) and John Mitchell Kemble (1807–1857), whose writings on Norma
and Anglo-Saxon England introduced a new era of investigation int

country. These pioneers were followed by a host of scholars who, all the specialised skill developed in the German *seminars* and the ch *écoles*, re-explored the records of the whole range of British his- Eminent among these were William Stubbs, Mandell Creighton, uel Rawson Gardiner, Frederick William Maitland, and Thomas erick Tout. Equal with them, but hardly in their midst, stood the Lord Acton; for, though British by birth, he was essentially pean. His universal genius and unparalleled erudition knew no ations of either place or time. His words were the utterances of the vated mind of Christendom.

nerica was not long in acclimatising the new scientific study of his- Here the German influence was dominant. Even the lyrical George roft (1800–1891), whose *History of the United States* is the despair l impartial critics, had sat at the feet of Heeren and enjoyed the dship of Ranke. But the true spirit of Heeren and Ranke did not and inspire American historiography until the time when, in or t the year 1857, Henry Torrey began to teach at Harvard, Francis er at Columbia, and Andrew White at Michigan. A further powerful tus was given to genuine historical research when H. B. Adams, from Heidelberg, was appointed to Johns Hopkins University in ; and when J. W. Burgess, on the model of Berlin, founded in 1880 ow famous faculty of political science in the Columbia University of York. To mention the names of their distinguished successors in ounger generation of American historians would occupy more space we can afford. For the same reason we can do no more than name, oneers of the new historiography in their respective countries, th of Austria, Palacky of Bohemia, Marzali of Hungary, Villari of Altamira of Spain, Carvalho of Portugal, Kopp of Switzerland, ne of Belgium, Fruin of Holland, Steenstrup of Denmark, Geijer of en, Keyser of Norway, Soloviev of Russia, Lelewel of Poland, and rigopoulos of Greece. In some of these notable scholars, it must be tted, the pure water of science was to some extent tinctured with the nd intoxicating wine of patriotism, but, taking them as a body, they oble work in freeing historiography from its discreditable associa- vith ignorance, indifference to truth, prejudice, and propagandism.

e of the first tasks to which the scientific historians had to turn their ion and direct their energies was the collection, classification, tabu- , and gradual publication of the vast masses of the raw material of y which lay either neglected, or closely secreted, or both, in the ves and libraries of Europe. In most countries they were able, by ling the patriotic note, and by drawing the attention of each govern- in turn to what other governments were doing (or saying they were to do), to secure official aid and public funds. The first of the great eenth-century collections of published authorities—obviously in- l by the anti-revolutionary and romantic reaction at the time in full e—was Petitot's *Collection de Mémoires relatifs à l'Histoire de France,* enced in 1819 and completed in 1829 by which time no fewer than undred-and-thirty volumes had been issued. In Germany, the very hat saw the initiation of Petitot's French series, saw the establish- by the patriotic Prussian statesman Stein of the Society for the Study of German History. This society decided to collect, edit, and publish tha great series relating to the history of mediæval Germany known as th *Monumenta Germaniæ Historica*. Five separate groups of publication were projected, namely, writers (*scriptores*), laws (*leges*), imperial acts letters, and antiquities. The first editor selected proved to be incompeten and effective work was delayed for several years. In 1822, however, a ideal director was found in G. H. Pertz, who remained for nearly fift years in charge. In 1826 the first volume of the *scriptores* appeared, an in 1835 the first of the *leges*. Before Pertz retired (to be followed as edito by Waitz) he had superintended the publication of no fewer than twenty five masterly volumes, representing the highest grade of mediæva scholarship. Contemporary with Stein was the notable Orleanist ministe F. P. G. Guizot (1787–1874), himself a historian of eminence, author c a *History of Civilisation* remarkable both for the sweep of its generalisations and for the brilliance of its style. In 1834, when he was minister c public instruction, he followed Stein's lead by organising the *Société d l'Histoire de France*, a body which—at first under the presidency c Barante, the romantic historian of the House of Burgundy—commence the issue of a series of volumes of sources for French history which no includes over 350 items. In addition to this society, Guizot secured th institution of a sub-committee of the ministry of public education itse which, out of funds provided by the government, began the publication c a *Collection de Documents inédits sur l'Histoire de France*, a collection c hitherto-unpublished sources, many of them of inestimable historic value, extending now to some 330 volumes. In a similar manner Belgiu began to publish its archives in 1836; Spain in 1842; Austria in 184 England, however, lagged far behind. The Record Commission appointe in 1800 had proved to be a complete failure. Fifty years later, Willia Stubbs and other of the new historians began to agitate for greater governmental activity and intelligence. As a result of their stimulation, nc only did the Stationery Office begin to issue its useful *Calendars of Sta Papers* (1857) but, the same year, was inaugurated the invaluable "Rol Series" of the *Chronicles and Memorials of Great Britain and Irelan during the Middle Ages* which, when it was completed in 1896, comprise 244 massive volumes. In 1869 a Historical Manuscripts Commissio appointed to examine and calendar important collections of documents i the possession of private persons or municipal corporations, began t issue its still unfinished series of reports and appendixes. Meantime th enterprise of such professional or local societies as the Camden, the Se den, the Hakluyt, the Surtees, the Cheetham, rendered useful assistanc in making available to scholars the documentary records of the past. I addition to these national treasures should be mentioned the great co lections of materials for general ecclesiastical history, and particularl the 382 volumes of Migne's *Patrologia* (1846–1864); the Vienna editio of the Latin Fathers (1866 et seq.) and the Berlin edition of the Gree Fathers (1897 et seq.); the papal *Regesta* of Jaffé and Potthast (1851 (seq.) and the great work of Hefele and Hergenröther on the Counci (1855 et seq.).

So immense, indeed, has been the output of historical material fro the various Record Societies, and from the works of private students, th has been expressed by more than one eminent authority lately lest vealth of production should exceed the capacity of historiographers onsumption. It has long since ceased to be possible for the student of ry to keep himself informed of anything approaching the whole of ast stores of new information which continue day by day to be pre- d to him by archivists and monographers. Specialisation has become and more minute, until there is imminent danger lest the general of " historian " should have to be dropped altogether ; lest even the particularised titles, such as " ecclesiastical historian " or " econ- historian " should have to be further qualified ; and lest, in time, e should exist capable of synthesising the new knowledge, capable of ulating any sort of philosophy of history, capable of seeing the wood the infinite multitude and variety of its trees.

V

le by side, however, with the development of scientific method, with rowth of the impartial spirit, and with the accumulation of historical rial, there occurred a notable change in the conception of history and functions. When history was regarded merely as a branch of litera- -" fiction grown to maturity " as it was once described—historians dered it as beneath their dignity to treat of anything much except oings and sufferings of royal and noble personages, the exploits of ors, the machinations of ministers. History almost realised Carlyle's ; that is to say it was little more than a compote of select biographies. ne did more than Carlyle himself—the last of the Romantics—with ulogies of heroes, his glorification of Frederick the Great, his ex- on of Cromwell, and his open contempt for the undistinguished mob, rpetuate the biographical conception of history. Carlyle, however, t a losing battle, and the fact that he was aware of it (together with ct of his biliousness) sufficiently accounts for the ferocity of his s upon the coming democracy in such essays as *Shooting Niagara*. growth of democracy, indeed ; the spread of socialism ; the rise of omic unrest—these and the other popular movements of the middle nineteenth century caused a new conception of history to prevail. rians such as Roscher in Germany, Avenel in France, and Macaulay gland, extended the scope of their enquiries and endeavoured to le in their survey the whole many-sided life of the people. Experi- however, soon showed that some sort of selection was necessary if ort of conclusion was to be arrived at. Macaulay, for example, set ith the intention of writing the history of England from 1688 to the five volumes published during the years 1849–1861 carried the no farther than 1700, and it was estimated that to have completed iginal design on the same scale would have involved the labours of er hundred years and the publication of a couple of score more vol- The necessary selection and concentration was secured in England e two academic leaders of mid-Victorian historiography—E. A. nan and John Seeley—by means of a rigid exclusion of everything t politics. " History is past politics ; politics is present history," was one of the slogans of the period. Nothing except state-papers was recognised as proper for investigation by serious historians. The revolt against this narrow conception of history, which reduced the subject to the position of a mere item in the education of the prospective Member of Parliament, was impressively proclaimed by Lord Acton in his memorable Inaugural Lecture (June 1895). “ Ours is a domain,” he said, “ that reaches farther than affairs of state, and is not subject to the jurisdiction of governments. It is our function to keep in view and to command the movement of ideas which are not the effect but the cause of public events.” In accordance with the principle thus enunciated, Lord Acton devoted the first lecture of his first great course on the French Revolution entirely to the intellectual movements of the eighteenth century, out of which he held the Revolution arose. The intense intellectualism, or even spiritualism, of Lord Acton (which had its parallel in the strong emphasis laid upon religion as a force in history by Döllinger in Germany) itself led to a reaction. The economic or materialistic conception of history was expounded and maintained by the school of Marxian socialists. The dominant influence of the subconscious and irrational impulses of human nature and of organised society was proclaimed by a powerful school of social-psychologists, led by Karl Lamprecht of Leipzig. At the present day, however, the more thoughtful and philosophical historians are recognising that no single factor can explain the multifarious phenomena of human society; that character and circumstances both play their part that neither free-will nor determinism expresses the whole truth respecting the source of man’s actions; that both ideas and irrational impulses, both soul and body, are ultimate realities, none of which can be explained in terms of the other.

Widely, however, as nineteenth century historians differed in thei conception of history, they all found their work unified and vitalised by the great principle of evolution which reached them from the realms of science and philosophy.

The idea of evolution—the master key to nineteenth century though —was not by any means a new one. The conception of a process of gradua unfolding or development, as opposed to a succession of catastrophic and unrelated creations, was as old as Aristotle himself: it was, indeed, one of the numerous features that distinguished the philosophy of Aristotle from that of his great predecessor, Plato. But the conception lacked verification in natural science as known to the ancients, and it remained mere speculation. It persisted until the dawn of the middle ages in the pantheistic system of the Stoics, but then for a thousand years it was submerged by the trancendentalism of Augustine and his school. It re-emerged, like so many other classical ideas, at the time of the Renaissance its first clear foreshadower being Giordano Bruno, who, for his numerou errors of judgment, was burned alive at Rome in A.D. 1600. From tha time onward it was never wholly absent from European thought, amon those whose works showed traces of its presence and influence bein Spinoza, Locke, Vico (*facile princeps*), Leibniz, and Lessing. Not, however, till the end of the eighteenth century and the beginning of the nineteenth, when the lead in philosophy passed successively to Kant, Schelling, and Hegel, did the evolutionary idea assume its dominant position

Hegel it became the key to world-history. He saw the whole process he political development of the human race as a gradual realisation of idea of freedom. The evolutionary conception of history, indeed, be- ne characteristic of the Romantics as a body. It entirely fitted in with ir desire to rehabilitate the middle ages. For it enabled them to argue t it was absurd to regard, as the Rationalists did, the whole period n Constantine to Columbus as a mere empty chasm separating two dred ages of enlightenment ; but that, on the contrary, it was necessary perceive beneath the surface of things one continuous purpose slowly king itself out in this and every age. The evolutionary idea, thus pted by philosophers and historians, was taken over by thinkers in ny other fields of investigation, *e.g.*, by reactionary theologians who nd in the theory of " the development of Christian doctrine " an ex- ent weapon with which to repel the attacks of evangelicals who con- ded that complete and final truth was revealed in the New Testament. he hands of Herbert Spencer it became the fundamental principle of omprehensive system of thought by means of which an explanation to be found of the processes whereby all existing phenomena had ne to be what they were. Not, however, until the works of Lyell in logy and Darwin in biology displayed the actual modes in which devel- nent had taken place in the making of the world and in the formation pecies did the evolutionary doctrine fully establish itself as the key- of the century.

he doctrine of evolution converted every branch of exact knowledge a science. All the phenomena of nature, of human nature, of society, of religion, had to be re-investigated in order to discover the way in ch they had acquired their existing characteristics. Since unvarying w "—that is an unbroken sequence of cause and effect—marked all processes in which evolution could actually be traced, it was assumed , if only men were clever enough, they could discover the same sort ' laws " in every sphere of investigation. This conviction was suc- tly expressed by John Stuart Mill : " All phenomena without excep- ," he said, " are governed by invariable laws, with which no volitions, er natural or supernatural, interfere."[1] In accordance with this view, main object of Mill's life came to be to discover the changeless ws " of man's moral and social evolution. The purpose of his *Logic* 3) was to formulate the method of enquiry proper to the sciences of . And the reason why he turned next to *Political Economy* (1844 and 3) was because he believed that in the science of man as producer, sumer, and exchanger of wealth, " laws " of the true positive kind d be most readily discerned—" laws " such as the " law of diminish- returns," the Malthusian " law of population," or the Ricardian v of rent."

Auguste Comte and Positivism, 2nd Ed. p. 12. Mill's statement is open to cism, *e.g.*, (1) The word " govern" is inappropriate; natural laws are not nands but merely generalisations; (2) For the word " invariable " the " unvarying" should obviously be substituted; (3) Volitions, whether nat- or supernatural, are among the phenomena which science is called upon plain ; in so far as they exist and operate they are not extraneous " inter- ces " with the course of nature.

In thus seeking to raise, or reduce, the sciences of man to the rank of the physical sciences, Mill was but following the lead of his great French master, Auguste Comte (1798–1857), who with immense erudition and enormous labour had constructed on a naturalistic basis the gigantic structure of the Positive Philosophy. Just as both theology and metaphysics had been banished from the realms of mathematics and astronomy, so, maintained Comte, would they ultimately be banished from the realms of every other science, including sociology. And he set himself to discover the " laws " that would account for the unaccountable vagaries of man, whether in solitude or in community. Comte was not an inductive historian, but a deductive philosopher. He made no serious attempt to survey from the positive point of view the tangled record of man's evolution here on earth. He had, however, an English disciple, Thomas Henry Buckle (1821–1862), who ventured to essay the prodigious task. His *History of Civilisation*—a fragment only of a vast projected work—the fruit of twenty years' intensive reading and concentrated cogitation, appeared during the years 1857–1861. It made a deliberate effort to formulate, particularly on the basis of statistics, a positive science of human association. It was a pretentious effort which, because of its originality of conception, because of its parade of learning, and because of its aggressive challenge to current religious and philosophical opinion, made a considerable sensation at the time of its appearance, giving rise to long and heated controversy. The controversy, of course, raged round the problem of determinism and free-will—the same problem as, according to Milton, occupied the attention of the fallen angels, before the creation of man, so soon as they had recovered from the preliminary shock of finding themselves in hell. Charles Kingsley, recently appointed Regius Professor of History at Cambridge, charged (extremely ineffectually) against Buckle's determinism in his inaugural lecture on *The Limits of Exact Science as Applied to History* (1860). Much abler and more effective was a lecture, entitled *The Science of History*, delivered at the Royal Institution in 1864 by James Anthony Froude—later published in the first volume of his *Short Studies*. But by far the most devastating reply—because the one most free from theological reprobation—was J. G. Droysen's *Erhebung der Geschichte zum Rang einer Wissenschaft* (1862), and his *Grundriss der Historik* (1858). Droysen asks what is the outcome of Buckle's pretentious induction ; what " laws " has he discovered and formulated ? He quotes some of them, and then remarks : " Laws of this sort could be discovered daily by the dozen, in the selfsame way of generalisation ; laws none of which would in depth and fruitfulness be less pregnant than the well-known saying that ' the measure of a people's civilisation is its consumption of soap.' " Finally, as the outcome of this controversy, as we remarked in the opening section of this essay, two important truths emerged, namely, that history differs from the natural sciences in respect both of its methods and its generalisations : (1) As to its methods, it is a science, not of observation or of experiment, but of criticism ; (2) As to its generalisations, since these relate, not to the realm of matter, but to the realm of mind—a realm in which motive and not force is supreme—a realm of consciousness and apparent freedom—they can never have that fixity and universality which are connoted by the term " law."

VI

he demonstration that history could not be elevated or degraded to rank of a physical science caused some serious questions to be asked ecting its functions, and particularly concerning its place in education. kle and his disciples had loudly proclaimed that, except as a positive nce, history was entirely worthless either for edification or for lance. Even idealists had seemed to concur. Principal Caird, for ex- le, in an address on *The Study of History* delivered at the University Glasgow in 1884 said : “ The expediency of introducing the study of ory into a university curriculum turns upon the question whether ot history is capable of scientific treatment. Knowledge which has yet been elevated out of the domain of fact and details, which has not nitted itself to the grasp of principles, or become in some measure ninated and harmonised by the presence of law, cannot, I suppose, be rded as a fit instrument of the higher education.” Principal Caird proceeded to consider the problem to what extent and in what sense ory could be regarded as a science, and he came to the conclusion “ though history cannot claim to be an exact science in the sense in ch we apply the name to mechanics or optics, or even to botany and siology, yet in its methods and results there is at least something so nalogous to these departments of knowledge as to entitle it to the e of science.” And as a science of a sort he considered that history d be used to widen the mental horizon, to train the judgment in im- iality, and to place men and events in their true perspective on the e of affairs. “ It tends,” he said, “ to give a true conception of what is sient as compared with what is lasting in human life.”

rincipal Caird’s sound and cautious opinion respecting the nature of ry as a science won general acceptance. His statement of the uses of ry, however, did not secure so wide an approval. Even now there is h divergence of opinion as to the place of history in education, and as relation to the practical affairs of men. If events do not repeat them- s ; if generalisations respecting historical phenomena are impossible, hat earthly use is it to study history at all ?

rst, as to the place of history in the education of the individual. Here ractical or pragmatical value of the study of history is not at issue. y subjects that have no obvious application to the business of life are o have high educational value. They act as mental athletics, develop- ntellectual capacity. Some pedagogues go so far as to contend that *nly* satisfactory subjects for school and university study are precisely that can be worked at without any disturbing utilitarian aim. at education is best,” said Mr. T. G. Rooper, “ which develops the est amount of mental force.” Most educationists, however, agree purposes other than the mere development of intellectual power d be borne in mind : people who are all intellect, and nothing beside ect, would be extremely dangerous members of society—predestined r bandits, financiers, commercial magnates, trade-union leaders, cians. Education should develop a moral control capable of keeping the ss intellect in check; it should impart a technical skill sufficient to e a man to earn his own living; it should train the citizen to perform his ions as voter and administrator in the community to which he belongs.

How far can history be made to subserve any of these general purposes of education? Sir Ray Lankester regarded it as wholly useless. "We should wish," he said in his lectures on *The Kingdom of Man* (1907), "we should wish to see the classical and historical scheme of education entirely abandoned, and its place taken by a scheme of education in the knowledge of nature." He admitted, however, that "to read history is a pleasant occupation," and that history has its worth "as an entertainment." On the other hand, writers like MM. Langlois and Seignobos in France, Herr Bernheim in Germany, and Professor J. W. Allen in England, contend that it is an invaluable instrument of intellectual training. "The study of history," says Professor Allen, "is capable of stimulating, of widening, and of assisting thought in many ways." He deprecates, however, any attempt to use it for emotional, ethical, or political ends. Other eminent men, however, among whom Lord Bolingbroke, Bishop Stubbs, and Mr. Froude stand prominent, consider that it is exactly the moral instructiveness of history that makes it educationally valuable. Says Bolingbroke, for example, "The study of history seems to me, of all other, the most proper to train up to private and public virtue." Few nowadays would contend that it should be employed as a vehicle for the conveyance of extraneous moral lessons; but fewer still would deny that its study widens the mental horizon, tends to elevate the character by bringing the student into contact with the great and the high, arouses the sympathetic imagination, shows the connection between the moral quality of action and the fate of the actor, and, as Lamprecht remarks, inspires the reader with "awe at the prodigious manysidedness and endless significance of human activities." To R. W. Emerson the function of history is loftier still. To him there is an exact parallel between the life of the individual and the history of the race. Man is the microcosm, Humanity the macrocosm. Hence in the study of history the individual can discover the secret of his own personality. The ages instruct the hours, and the hours the ages. On the one hand, all history is implicit in the individual mind; on the other hand, the character and destiny of every man are explicit in history. It must be admitted that Emerson gets very near to the margin of nonsense. It is true, however, to say that a knowledge of history, as a synthesis of events, is necessary to anyone who would have a complete and balanced conception of the world as a whole. It alone can place the phenomena of the present in their proper perspective; it alone can portray the field of life in its entirety; it alone can enable the traveller who takes "his one day's rest" in the mysterious Tent of being to survey his strange surroundings *sub specie perennitatis*.

Secondly, as to the function of history in civic education and in public life? Is a knowledge of history of any really practical use? What are its relations with politics? That the rulers of most states consider the teaching of history important is indicated by the care with which they censor the text-books used in the schools, and attempt to tune the teachers. A report presented to the London County Council shortly before the War remarked that "in France the teacher is told to preach national republicanism as against monarchy and internationalism. In Prussia still more definitely he is told to preach the advantages of monarchy, as exemplified in the reigning house of Hohenzollern, and the danger of modern

m. On the other hand, in Queensland he has to found all his his-
iching upon the doctrine of the sanctity of state property." The
nces of the past twenty years have perhaps done something to
he faith of politicians in the efficacy of propaganda in schools.
heless, even though war and revolution have run their courses,
see Germany continuing to tune her teachers, although now to
melody of federal republicanism ; we see the Soviet Government
ia subordinating every element in the curriculum of both schools
iversities to the inculcation of Bolshevism ; we see Italy making
the keynote of all its history teaching. Perhaps in course of time
ans will come to learn that nothing is so likely to defeat its own
propaganda in schools. The things that students love least are
hings that have been drilled into them by pedagogues ; and the
that, as they grow older, they are most disposed to doubt are
y those which have been impressed upon them in their infancy by
ble authority. This is a lesson which might with advantage be
n mind by a number of worthy people in all countries who are
secure the aid of educational authorities in their endeavour to
history teachers in the public schools as missionaries for paci-
cosmopolitanism, and other causes which they consider to be

en history should not be used, and if, as is probable, it cannot
ely be used, as a means of propaganda, what service may it be
render to civic and political education ? A good general answer
ded by Professor Seeley in his lecture on *The Teaching of Politics*
" History," he says, " is the school of statesmanship. Without at
ittle knowledge of history, no man can take a rational interest in
, and no man can form a rational judgment about them without a
eal. It is an important study to every citizen ; it is the one im-
study to the legislator and ruler." If we ask more precisely
consists this civic and political value on which Professor Seeley
ngly insists, I think the answer will be a threefold one. History
first, as a school of political method ; secondly, as a storehouse of
precedent ; and, finally, as the basis of political progress.

istory as a School of Political Method. It is true, although not the
ruth, that history is past politics, and politics present history.
bject matter of the two is the same. Both of them deal with inde-
te facts, and both seek to discover behind the doubtful veil of
hidden spring of motive. They are socio-psychological sciences
reat not of the definite and regular phenomena of inanimate
but of the incalculable movements of peoples and the workings
orporate mind. Both the politician and the historian have to argue
certain data ; neither can ever attain to any nearer approach to
an probability. One of the first lessons that the historian learns
begins his investigations into the course of any movement of
s the extreme and even insuperable difficulty of arriving at the
and indisputable truth. Examples of this difficulty abound ; but
the following illustration taken from very recent happenings may
When Mr. Lloyd George was prime minister, Messrs. Krassin
meneff, envoys of the Soviet Government, visited the House of

Commons to hear his speech on Poland. These are the reports of eye-witnesses from the four London evening papers published the same day :

" EVENING STANDARD "	" STAR "	" EVENING NEWS "	" PALL MALL GAZETTE "
" In conversation they seemed to betray only a limited acquaintance with English ; but every word of Mr. Lloyd George's utterance seemed intelligible to them. Not only did they follow him with eager interest, but often with animated comment."	" Krassin could follow every word of Lloyd George. His colleague does not speak or understand English ; so Krassin every few minutes leaned over and whispered a translation into the other's ear."	" The two did not exchange a single remark during the whole of the Premier's speech."	" The Soviet envoys, especially M. Krassin, seemed somewhat restless, and appeared to take more interest in the scene than in the speech, but this I heard attributed to their difficulty in following the words of the Prime Minister."

It will be seen that in these first-hand records of the event under review there is an irreconcilable conflict of testimony, first, as to whether M. Krassin could or could not follow Mr. Lloyd George's speech with ease ; secondly, as to whether M. Kameneff could or could not understand the speech at all ; thirdly, as to whether or not either of them was interested in the speech ; and finally, as to whether or not they spoke to one another during the course of the speech. Who shall say, in the presence of these four eye-witnesses, what was the truth of the matter ? And this is only an extreme example of what is the case with every historic event. It is *never* possible to say with certainty of any occurrence whatsoever *wie es eigentlich gewesen ist*. Similarly in politics nothing is positive.The mind of the publicist is the field of a constant conflict of improbabilities ; he is perpetually called upon to weigh and measure rival uncertainties. The only important difference, indeed, between history and politics is that the one is cold and the other is hot. But this difference is vital : for just because it is possible to handle the problems of past politics—say the politics of Periclean Athens or Augustan Rome—with coolness and detachment, the study of history is so valuable a school of method. For history teaches caution, impartiality, charity ; it gives a sense of the complexity and uncertainty of socio-psychological phenomena ; it provides practice in the subtle art of arguing from external acts to internal motives and ideas.

(2) *History as a Storehouse of Political Precedent*. History is more than a school of political method ; it is a storehouse of political precedent. The problems which face the present generation have in one form or another come up for solution many times before. It is true that history does not repeat itself. It is true, indeed, that it cannot be made to repeat itself ; for every event which occurs adds something to the environment of every subsequent event and is a factor in its causation : so that the mere fact that a thing has happened once presents an insuperable barrier to its ever happening again. But the same is true in individual life. No person ever finds himself twice in precisely the same situation, nor can anyone discover unvarying sequences of cause and effect in the relations between himself and his fellows ; yet, notwithstanding this, every man in his mature years is guided and governed by his experiences as recorded in his

mory, and by the principles of conduct which his judgment has de-
ed from them. As with the individual, so with the race ; but subject to
s important difference—that the race lacks the personality, that con-
uity of self-consciousness which marks the individual. It has no
ural memory, and in order that it may not lose the vast accumulated
alth of the experiences of the past, a memory has to be created for it.
at race-memory is history. Through history mankind attains to self-
sciousness. As Droysen says : *die Geschichte ist das* γνῶθι σαυτόν
Menschheit, ihr Gewissen (History is the *know thyself* of mankind, its
science). By means of this self-consciousness humanity is able to be-
ne to a degree otherwise wholly impossible the master of its fate ; it is
e to control its destiny, and to move deliberately forward on the path-
y of progress.

t is neither possible nor necessary to give here many examples of the
y in which one generation has learned from the experiences of its pre-
essors. In a sense all historiography is an exposition of this theme.
e following may perhaps suffice. Elective monarchy has much to com-
nd it on theoretical grounds ; yet it has been removed from the sphere
practical politics by the experiences of imperial Rome, mediæval
rmany, and modern Poland. Again, the old " mercantile system " of
onial policy is capable of very powerful defence on general principles ;
the revolt of the American Colonies has rendered its revival in the
tish Empire for ever inconceivable. In other cases precedent is not
conclusive ; but it always deserves attention. For instance, no discus-
n of the merits and defects of single-chamber government can be re-
ded as adequate if it ignores the experiments of the English Common-
alth and the French Revolution. Similarly, no advocacy of the abstract
ight to work " can be considered satisfactory unless it explains away
due to accidental circumstances the ghastly results of the recognition
the right in Paris, 1848. Nothing, indeed, can be alike more futile or
re dangerous than to treat politics as though it were an abstract science,
orced from the lessons of historic experience. Well says David Hume :
f we consider the shortness of human life, and our limited knowledge
n of what passes in our own time, we must be sensible that we should
for ever children in understanding were it not for this invention which
ends our experience to all ages past, and to the most distant nations,
king them contribute as much to our improvement in wisdom as if
y had actually lain under our observation. A man acquainted with
tory may, in some respect, be said to have lived from the beginning of
world, and to have been making continual additions to his stock of
wledge in every country."

3) *History as a Basis for Political Progress.* History does more than
ply the politician with precedents of completed experiments. It gives
the actual antecedents of present-day problems. Next to the danger of
ting political questions in the abstract, as though they had no ante-
ents at all, nothing is so fatal as the error of supposing that those an-
dents can be ignored in any settlement that aspires to permanence.
e failure of the English Puritans in the seventeenth century to estab-
their régime, and the failure of the French Revolutionists in the
teenth century to maintain their institutions, was in each case due

largely to the disregard of historic continuity. In each case, fired by zeal and inspired by novel ideas, the reformers broke too completely with the past. Ignoring the fact that the state is organic in its nature, they threatened its life by their drastic surgical operations. Hence in each case the patient rose in horror and in terror, and drove them out.

All the great political and social questions of the present day have long histories. In Europe, for instance, the English poor law problem, as set forth in the Report of 1909, is essentially the question whether England shall revert to the principles of 1834, of 1795, or of 1601. Again, the English franchise problem takes us back through the Reform Acts to the days of Edward I and Simon de Montfort. The English constitutional problem, too, has its roots far away in the folk-moots of the primitive Germanic peoples. Similarly, the Eastern Question is but a phase of that perennial conflict between Asia and Europe which was incalculably old even when the Greeks met the Persians at Marathon. And the Simon Report of 1930 has shown what a close and intimate study of Indian history is necessary to anyone who attempts to deal with the modern question of Indian self-government. In fact, the consideration of every great European problem that is now in the forefront of practical politics confirms the words of Sir John Seeley already quoted—History " is an important study to every citizen ; it is the one important study to the legislator and ruler."

The same truth is emphasised by a survey of the problem prominent in America. The fundamental controversy between the federal government and the state governments has, in order to be fully understood, to be traced back to the old colonial days when the central authority was located in Great Britain and when each of the thirteen colonies was wholly independent of all the others. Similarly, the question of the social and political position of the negro goes back to the days of mercantilism, when a profitable slave-trade supplied America with a cheap labour the mode of whose procurement caused no shock to the Puritan conscience. Some peculiarly American problems, such as the prohibition problem, seem at first sight to be new. Nevertheless, even these, though in appearance novel, are in substance old. The prohibition problem, for example, is but a manifestation of the constantly-recurring clash between liberty and authority—liberty capable of doing wrong and authority determined to enforce the right—which originally presented itself for solution in the Garden of Eden.

VII

For convenience' sake in the last section the word " politics " has been used as the antithesis to " history "—an antithesis corresponding to that between " present " and " past." To avoid misunderstanding, however, it is desirable to explain that the word is used in no narrow or restricted sense. It is intended to apply to, and include, the interests and concerns not merely of the state but of every other form of public human organisation. To make this clear is all the more necessary because, as has already been mentioned, some of the older historians limited themselves rather rigidly to the affairs of government—that is, to wars, to diplomacy, to legislation, to official administration, to judicial proceedings. Thucydides,

haps, set an evil precedent by the complete concentration of his atten-
n upon Hellenic state affairs, to the entire exclusion of the rich cul-
l activities and acute economic crisis that marked Athenian and
rtan history in his day. Certainly in the nineteenth century the influ-
e and example of the great Leopold von Ranke tended to keep his-
ography on narrow political lines. In England, Freeman and Seeley
e historical politicians of the straitest sort.

Sut more and more as the century advanced were the barriers that
ricted historical investigation broken down, until it is generally recog-
ed nowadays that nothing is " beneath the dignity " of history's notice
outside the scope of its ken ; and that all the doings and sufferings of
nkind in every walk of life are proper subjects for the historian's in-
tigation. Nay, more ; it is realised and asserted that unless historians
as a matter of fact, take this extended and all-comprehensive view,
y are bound to present a distorted picture of whatever age they may
fess to portray. In short, it is perceived that history is not an isolated
ject of study, but is one of a group of kindred studies which together
ke up a general " science of society "—a science foreshadowed by the
lytical genius of Comte in France, and by the synthetical ability of
ncer in England ; a science to which, in order to show their contempt
he old classical tradition, its founders attached the hybrid name of
ociology." Few teachers of history in the nineteenth century did more
spread the conception of history as a branch of sociology, or to
ngthen the links which bound history to the other branches of the
nce of society, than did Karl Lamprecht of Leipzig, from whose
ous *seminar* zealous sociological historians swarmed over the civilised
ld. Unfortunately, they carried with them not only Lamprecht's
e conception and admirable methods, but also some of the bees which
harboured in his hospitable bonnet—in particular his preposterous and
crustean " culture-epoch " theory.

mong the sociological studies with which history is now closely
iated none is more important than economics. Although the exagger-
l dogma of the exclusively economic interpretation of history which
rx and Engels formulated has been abandoned by all responsible
kers, historians recognise that economic factors have played a promi-
t part in all epochs of the world's social evolution, and particularly in
se early epochs when man had to wage a ceaseless struggle for exist-
e against natural enemies almost as powerful as himself. All politi-
s, moreover, realise that once again economic problems have come to
forefront of human interests. Hence at the moment economic history
s precedence of all other branches in the public attention.

second ally of the new historiography is geography. No subject has
n so completely revolutionised and transformed in recent years as
graphy. It also has been brought within the ambit of sociology and so
nanised. It is no longer regarded as the science of the earth, primarily
ciated with geology, but rather, as the science of man conceived of in
tion to space, having its main connections with history, the science of
conceived of in relation to time. Hence historical geography has been
eloped, to the immense advantage of scholarship. Of course, some his-
cal geographers, fired with the zeal of young explorers, have gone too

far. When, for example, one of them explains religion purely by means of climate, and says that " monotheism is the product of the desert," we realise that we are in face of an absurdity of the same sort as we meet in the Marxian assertion that the Reformation was the product of bourgeois capitalism. Excessive claims of this kind, however, are soon reduced to reasonable limits by the attrition of criticism.

Further allies of history at the moment are anthropology and archæology.[1] No influence has been more powerful than that of anthropology in impressing upon historians the profoundly important truth of the essential unity of the human race. Archæology, for its part, has extended inconceivably the historian's conception of the immensity of the periods of time during which human society has been developing. The vast " prehistoric " (that is unrecorded) epochs have been revealed, and in a marvellous manner explored. So lately as the close of the nineteenth century chronologies were published and believed that placed the creation of the universe in 4004 B.C. and comprised the whole course of human history within a span of less than six thousand years. Archæology dates the Piltdown man at 100,000 B.C.; the Heidelberg man at 250,000 B.C.; and the Java ape-man at 500,000 B.C. It hints, moreover, that these are by no means likely to be the limits of its revelations. But not only has archæology opened up new realms of knowledge respecting palæolithic and neolithic man; it has also, by means of its discoveries of relics of the extinct civilisations of Egypt, Babylonia, Crete, and Asia Minor, added vivid chapters to our cognisance of ancient history.

Two significant results of these revelations of anthropology and archæology have been, on the one hand, the critical revision of the whole Biblical story of the creation and fall of man, together with an illuminating reconstruction of the records of the early doings of Israel; and, on the other hand, the complete abandonment of all the older attempts—from Augustine's to Hegel's—to formulate a philosophy of history. In short, history has ceased to concern itself with *a priori* speculations as to the purpose for which the world and man were created, or as to the inherent metaphysical ideas which the time-process is making explicit, and it has placed itself in line with the other sciences which are endeavouring to explain to the human mind the meaning of things as they are.

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[1] For the importance of anthropology and archæology as aids to historical study, see the Articles on *The Beginnings of Morals and Culture* and *The Achievements of Archæology*.

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MODERN GEOGRAPHICAL IDEAS

By

L. DUDLEY STAMP

SYNOPSIS

lern geography entirely changed in the present century — The
geography merely descriptive, the new seeks to search out cause
effect —The disappearance of the gazetteer type of geographical
-book — Modern geography essentially the study of human
ronment : the world as the home of man — The chief factors of
environment : topography, structure, climate, vegetation and
ial life ; their influence on man and his reciprocal influence —
major climatic regions of the world : equatorial, tropical, mon-
, hot desert, mediterranean, warm temperate, cool temperate,
perate continental, east coast, temperate desert, cold temperate,
c ; each considered in relation to natural resources, economic
lopment and the life of man — World geography and inter-
onal relations : the inevitable dependence of the United States,
ada and Russia on outside supplies of tropical products — Mal-
ibution of population : the problems of Japan and China — The
anation of Franco-Italian rivalry — Barriers and frontiers —
graphy and nationality : the systematic study of a country or
n — The siting of towns : London, New York and St. Louis —
clusion : the modern world geographically minded.

MODERN GEOGRAPHICAL IDEAS

I. INTRODUCTION

Geography has been described as at once an art, a science and a philosophy. Such a description may well carry its own condemnation: how can a subject whose field is so broad have any depth, or any concrete form and expression? Does it not indicate that the so-called "subject" of geography is merely the common meeting-ground of such sciences as geology, physiography, meteorology, ecology and economics, and that its entity is imaginary rather than real? Similarly, if geography is regarded merely as "writing about the earth" (Gk. γῆ, the earth; γράφειν, to write) and synonymous with a description of exploration or travel, is it not true that geography must automatically come to an end as the continents become entirely explored and known?

To answer these two questions it is necessary to attempt to disentangle the modern point of view from the discarded axioms of a subject which has had a varied career for more than two thousand years, since Aristotle, or perhaps Eratosthenes, first used the name. Aristotle, in the fourth century B.C., must be given the credit of being the founder of scientific geography. He demonstrated the spherical form of the earth (the size of which was later calculated by Eratosthenes) and realised that the then known habitable world only occupied a portion of its surface. If Aristotle was the founder of mathematical geography, Strabo (50 B.C.–A.D. 24) was the founder of regional or political geography, and in his descriptions of the countries surrounding the Mediterranean Sea anticipated some of the concepts of the human geographers of the nineteenth century. The Middle Ages, with the literal interpretation of Scripture, saw the death of scientific geography in Christendom, if not in Islam. But the voyages of Marco Polo did much to re-create interest in the scientific conceptions of Aristotle and Ptolemy, Homer and Herodotus. The voyages of Columbus and the Great Age of Discovery show the *faith* in the old resuscitated ideas; the geographer (under the title of cosmographer) became a personality whose opinions were sought and valued in the highest circles. The return to England in 1547 of John Dee—mathematician, astrologer and cosmographer—with the globes of the Renaissance geographers of Louvain, coincides with the beginning in England of serious participation in the exploration of America.

A scientific geography, concerning itself with the recognition, characters and classification of regions, was conceived in the seventeenth century by a German geographer, Bernhard Varenius, whose original work (1659) was reissued under the influence of Sir Isaac Newton at Cambridge in 1672.

Later, the extension of exploration in the Georgian and Victorian eras necessitated the setting down of innumerable facts of discovery

l the production of almost equally numerous maps and charts to
strate these discoveries. In the words of the old text-book definition
graphy became " a description of the world and its inhabitants." The
erly catalogues of the facts to be recorded produced admirable
etteers : it is significant of the gazetteer age that the voluminous and de-
ed description of the great Indian Empire was christened the *Gazetteer*
ndia. The gazetteers had to be condensed and summarised to produce
:-books. So it came about that the science of geography died, and there
se in its stead a monstrosity pouring forth a torrent of words, loathed
ve all other deities by the average schoolboy, despised and condemned
the adult. The writer's earliest recollection of the worship of this mon-
ous deity is the recitation of a creed which commenced : " North-
berland, Newcastle on the Tyne ; Durham, Durham on the Wear ;
mberland, Carlisle on the Eden ; Westmorland, Appleby on the Eden ;
ncashire, Lancaster on the Lune ; Yorkshire, York on the Ouse." The
:-book led off, accompanied by the most wonderful variations in type,
h the remark that " ENGLAND (*that is* the *land* of the *Angles*) is the
thern portion of Great Britain. Its greatest LENGTH is 420 miles,
ADTH 360 miles, and AREA over 58,000 square miles."

Jnfortunately, this old Geography is scarcely yet dead. After all, it is
type of learning which passed under the name of Geography in the
ooldays of many who will read these lines ; for it was not until the
y years of the present century that Modern Geographical Ideas
etrated into America and into England, and not until later that the
dern Geography began to be taught in the schools and to be embodied
ext-books.

n 1905 Andrew John Herbertson, Professor of Geography in the
iversity of Oxford, published his *Major Natural Regions : an Essay*
Systematic Geography (*Geographical Journal*, vol. xxv., p. 300); in
2 Sir Halford Mackinder, then Director of the London School of
nomics and afterwards Reader in Geography in the University of
ndon, had published his *Britain and the British Seas*, in the series
he "Regions of the World" under his editorship. The development of
dern Geography may be said to date in Britain from these two publi-
ons, and it is not too much to say that within the last twenty-five years
subject has changed so completely and fundamentally in its outlook
methods. In America Ellen Churchill Semple's *American History and*
Geographic Conditions (1903) provides a corresponding date. The
logues of facts which formed the fundamental part of the old Geo-
phy were capable, it is true, of study with the object of determining
erlying causes. But such study was for the few, and although one may
that the method of the old Geography was to work from effect to
e, the normal student rarely penetrated beyond the catalogue of
cts. With the dawn of the new Geography it came to be realised that
nited number of causes, capable of detailed study, were in the main
onsible for the multitude of otherwise unrelated facts. So the method
udy of Modern Geography is to search out causes, and to work in a
cal sequence from cause to effect. Hence the descriptive term often
of " causal geography "—perhaps unfortunate because of the ease
which it can be misread as " casual geography."

New wine is apt to go the heads of earnest pioneer missionaries, and the new Geography soon made enemies—as readily as it made converts, for there is no denying that many early exponents went too far. Whilst this is not true of the pioneers in Britain—Herbertson and Mackinder—it is a criticism which can be levelled against the school of Ratzel in Germany. Ratzel insisted on the control of human activities by natural conditions, on the permanency of those conditions and the strictness of the limitations they impose ; in other words, human development along certain lines is inevitable given a certain set of physical conditions in the environment. Some of Ratzel's followers, especially in France, went so far as to agree with Demolins that if history were to begin all over again, it must in all essentials follow the same lines, given the same setting of the natural stage. This school of " Determinism " insisted on the absolute " geographical control " exercised by the newly studied geographical factors.

The great French geographer Vidal de la Blache did not fall into this error, but recognised the creative power of human beings to exercise a reciprocal control or influence on their environment, to adapt themselves to natural circumstances, deliberately to attempt the moulding and even reshaping of their environment. Thus "geographical control " becomes modified, by the conception of a reciprocal control, to one of " geographical influence."

We are now in a position to answer the two questions postulated at the beginning of this article. To take the second one first : the completion of the exploration of the world and the collection of adequate data is only the beginning of modern scientific Geography. Analysis of the recorded facts must precede any attempt to make a synthetic study of the factors of the environment which have exercised a dominant influence on the development of a tract and its inhabitants, and will continue to influence development in the future. This brings us naturally to the answer to the first question. Geography is the study of the world as the home of man—of the physical environment of the human species. No other science is concerned with that human environment as such : the geologist may study the rocks of the earth crust ; the meteorologist may concern himself with the climate and weather ; the botanist with the plant life and the zoologist with animal life. The geographer requires just so much of the results of each of those sciences as may enable him to appreciate, as a living concrete whole, the stage whereon man is required to live his life and play his part.

II. THE GEOGRAPHICAL FACTORS

We have attempted to show that the modern geographer is concerned primarily with the study of the earth as the home of man. His first task is to disentangle the factors which go to the making up of that environment and to trace the influence exerted by each severally, as well as by the whole collectively, on the life and activities of man.

Topography or Physical Features

Switzerland, as all the world knows, is a mountainous country. No effort of man can ever remove those mountains and substitute for them a lain. Similarly, if a country is flat no effort of man will provide it with ıs of mountains. It is obvious, therefore, that the topography or phy- geography of a country must play a permanent and leading part. the mountainous regions of North Wales and the lowlands of East ia are primarily farming countries ; the relative sparseness of the ing population in the former, contrasted with the denser and well- ibuted farming population of the latter, is essentially the result of the ence in topography. Comparable examples may be drawn from al- any part of the world. Even in the most densely populated country h the world knows at the present time—China—it is the flat land and ys which teem with people, the intervening mountains which remain ed and bare and almost uninhabited. It is significant of the modern eciation of the paramount importance of this factor, that our present- naps and atlases are nearly all topographical or physical maps. In ost-War *magnum opus* of the famous map-making firm of Bartholo- , *The Times Survey Atlas of the World*, the majority of the maps are coloured, so that they show at a glance the physical features of each try : the lowlands in green, the intervening areas and low plateaus in brown, the mountains in dark brown and increasingly dark colours. this we may contrast any one of the old atlases, where colour is used stinguish the various political units, and mountains are shown in- tally as caterpillars crawling uncertainly about the face of the map. ist be noted that the physical map does not replace the political map, litical boundaries can be clearly shown on top of the representation ysical features. One is thereby enabled to see at a glance how far daries between countries have been determined by physical features, ow far they are purely artificial in that they run in straight lines s featureless country. Thus Poland stands out as an irregularly- ed fragment of the north European plain, with no clear features to ate it from Germany on the one hand or Russia on the other. By of contrast the formidable Pyrenees form the natural boundary be- n France and Spain, cutting off the whole Iberian Peninsula from the of Europe.

e physical map, also, by showing clearly such features as river basins, go far to suggest what may best be termed the " outlook " of the e. So often do rivers act as highways of trade and of culture that they ogether the riverine peoples and the peoples of the basin as a whole. e other hand, peoples who are separated by a natural barrier such as ge of mountains, tend to have entirely different outlooks and ways ought. Thus the people of Burma are in the main the people of the of the Irrawaddy : the heart of the basin and the fertile lowlands are ited by Burmans ; the tangled masses of hills which surround the are occupied by allied hill tribes. But, except indirectly by sea, is really no contact—racially, culturally or economically—with the es living on the other side of the wall of mountains which separates rovince of Burma from India proper. It frequently happens, as in ase, that the mountainous belt is itself inhabited by people alien to lain-dwellers on either side.

t as easily as we refer to the physical features on the physical map rge country, we refer to the topography on the topographical maps of smaller tracts. For the function of the topographical map is similar. From the detailed topography of small areas we can comprehend the direction taken by main roads and railways and the way in which the meeting-places of such natural routes are marked by the presence of towns or villages. It is often possible to see from such a map the reasons for the location even of single habitations. So important is the topographical map that there is perhaps a danger of over-emphasising it. It is the culmination of the labours of the surveyor, but is only one of the aspects of a country which must be considered by the geographer. Thus the surveyor and the explorer, however exacting and however precise their work, are not necessarily geographers.

We have referred above to the reciprocal influence exerted by man on the features of his environment. Man's influence on the physical features and topography of the earth's surface is but comparatively small. It is true that he may modify or even nullify the effects of such barriers as mountains by cutting through them with a railway tunnel. Especially in urban areas he may do much to mask the original topographical features of the ground, though even in extreme cases the influence is comparatively slight. Two thousand years of building have not hidden the existence of a hill in the heart of London, now crowned by St. Paul's Cathedral, which formed at least one reason for the existence of the early London.

Of somewhat greater significance is man's activity in the reclamation of land : the conversion of the mediæval Fenland round the Wash in England into the fertile, agricultural land which it is to-day, is really an example of this character. And at the present time there is the ambitious project of the Dutch for reclaiming the greater part of the shallow Zuyder Zee. The existence of this reciprocal influence, however, does not mask in any way the real importance and significance of the topography or physical features of a country—the first aspect which it is really the duty of the geographer to consider.

Geological Structure

The surface topography of a country is really only the reflection of its underlying geological structure. Logically one should take structure first, but topography is a matter of observation, structure a matter of subsurface investigation combined with surface investigation and the interpretation of the results—an interpretation which may vary according to the worker. Hence, in many areas the interpretation of the underlying geological structure is still a matter of conjecture. But only a small portion of the field of the geologist is also the concern of the geographer. The underlying structure, in so far as it determines the character of the land surface, is obviously important, and at the present day forms a subject of its own known as geomorphology. The geographer, together with the geologist, is also concerned with the agents of denudation which shape the surface and are responsible for the continual changes which are taking place. The geographer is not concerned with the study of the rocks of the earth's crust as such—that is the field of the petrologist ; but he is concerned with the classification of rocks in so far as they affect the character and land forms of the earth's surface, and particularly in so far as

concern the distribution of the useful minerals which have such an
ction for modern man.

om the geographer's point of view it is possible to distinguish four broad groups of rocks, or, one should say rather, geomorphological r regions. These are as follows :

Areas of old, hard rocks, resistant to denudation, which give rise to plateaus, and, because of the resistant character of the rock, usually sh rather poor soil. The rocks themselves may be either crystalline morphic), or may merely be old and hardened sediments. The exact gical age is scarcely a matter of real importance to the geographer ; at the geological map which distinguishes Cambrian from Ordo- is less important than one which distinguishes the lithological cter of the rocks themselves, *i.e.* which separates tracts of hard alline rocks from relatively soft sandstones. Amongst the major au regions of the earth's surface, composed of ancient metamorphic her rocks, may be mentioned the Brazilian plateau and the Guiana lands in South America, the greater part of Africa except the north, reat plateau of Arabia, the great plateau of Peninsular India, con- able portions of Indo-China, the great plateau which makes up the rn two-thirds of Australia, the great plateau of central Siberia, Scandinavia. With the latter may be linked the Highlands of Scot- and north-western Ireland.

Areas of ancient rocks which, in the course of long ages of denuda- have been worn down almost to sea-level. Among such areas may entioned the Laurentian Shield of Canada, a vast tract occupying y two million square miles, a second area being the great Russian rm which underlies the greater part of Russia in Europe, and which s to the surface round the borders in, for example, Finland.

Areas of young, soft rocks, which usually give rise to lowlands or s, and which tend to furnish a soil, as well as a topography, suitable riculture. The great alluvial plains of the world form a subdivision s group. Amongst such major regions of young soft rocks may be oned the Central Plains of North America ; the Orinoco, Amazon araguay plains in South America ; the North European Plain, which ies the greater part of the north of the mainland of Europe ; the lowland of western Siberia ; the great river plains of the Tigris, the rates, the Indus, the Ganges and Brahmaputra, and the rivers of ; as well as the central lowlands of Australia.

The great folded mountain chains of the world are composed usually hly-folded sedimentary rocks ; many of these chains arose in the last period of mountain-building movements, the period of the middle ary, when there appeared the Alps, the Himalayas, the Rockies and ndes. The Tertiary was the last of the three great periods of time guished by geologists; it was the period when mammals established supremacy and the ancestors of man himself made their first ap- nce.

metalliferous minerals tend to be associated with the areas of t rocks, but rarely with the areas of young, soft, sedimentary rocks, ot very abundantly, except locally, with the young folded moun- Iron and some of the ores which occur in alluvial deposits form exceptions to this rule, whilst the non-metallic minerals, foremost amongst which are coal and oil, occur of course in sedimentary rocks. Turning to the direct influence of the structural geology on the activities of man, it may be pointed out that man is quite incapable of placing a coalfield where a coalfield has not already been placed by nature, or of discovering any new metalliferous deposit where such deposit has not been hidden by nature. Economic development consequent upon the discovery of mineral deposits must of necessity be controlled by the position of the deposits concerned. The reciprocal influence of man on geological environment is even smaller than in the case of reciprocal influence on the physical features. The casting of manure on the land is an attempt to overcome the disadvantages which are the result of the natural mineral constituents of the soil ; but even so the example is not a very good one.

Climate and Weather

Although it is not so obvious, the influence of climate and weather is of equal importance with that of physical features and structure. In our everyday life we react so automatically to changes in weather that we do so almost unconsciously ; the fact that those who dwell in colder climes don an overcoat at certain seasons of the year is a natural reaction to weather conditions. In such a fickle-weathered country as England, the inhabitants decide from day to say whether they will go out furnished with umbrella or mackintosh. Our bodies form sufficiently sensitive thermometers to determine when in the autumn we have a desire to see a fire, or to turn on the central heating, as the case may be. The date of that celebrated annual event, which is the *bête noire* of almost every English householder, namely the spring clean, is really determined by climatic conditions, when the dirt-making coal fires of winter are no longer required.

Climate is commonly defined as the average state of the weather and we show our trust in the recurrence of climatic conditions by taking, as far as we can, our holidays in June, July or August—our summer months. Probably, if we are fortunate enough to possess the wherewithal, we venture to escape from the hateful cold of New York in the heart of the winter and change those conditions for something more pleasant on the coast of Florida ; or after the Christmas festivities we learn to hate the damp cold of London and turn our attention to the sunshine of the Riviera. If we venture to the Tropics, we automatically change our clothing ; if we live in the Tropics, we probably change our mode of life and our food to a very considerable extent. The form of man's dwelling-places has been determined to a very large extent by climatic conditions. The steep-roofed houses of northern latitudes, from which the snow may slide away easily, form a remarkable contrast to the flat-roofed houses of the dry lands, of the Mediterranean or the Tropics. Often these flat roofs have a slope towards the centre and a tank below in which rainwater, precious to the inhabitants, may be collected. If rain is abundant, we shoot it off our roof on to our neighbour's garden ; if rain is scarce, we carefully collect it on our own roof for our own use. We see the influence eat in the wide shady piazzas of Italian houses, which form an interg contrast to the modern " sun-trap " house which architects have eavoured to perfect for such sun-starved climes as parts of England. he effect of climate is even more marked in the vegetable world. n in a single small country such as Great Britain this is well exempli- How often does one see in the north of Scotland fields of wheat ? there it is too cold for the ripening of this crop. How often does one ields of wheat in Ireland, where it tends to be too wet for that crop ? to the fields of East Anglia that one must turn to see this crop growoest. How many New Englanders have seen in their own countryside s of cotton opening to the late summer sun ? Very few, if any. Yet the yearly privilege of the southerner. We realise that the familiar e or tea or cocoa of the breakfast-table has to be brought to us from ad, but we do not always realise that it is climate which is a controlfactor in this case. We need make no excuse, therefore, for stressing extreme importance of the climatic factor in geography. It may be d if this is not the field of the meteorologist, but it must be empha- again that the geographer does not require the whole of meteoro-. He is scarcely concerned with the design and character of the uments by which meteorological records are made or kept ; he is coned with the interpretation of the results, with the way in which the equent climate and weather affect the life of man, whereas the orologist may, and usually does, content himself with the actual pretation of the climate and weather as such.

urning to the reciprocal influence of man on climatic conditions, we that it is possible to do far more to alter or nullify the effects of atic conditions than to alter or nullify the effects of physiography or cture. The clothing which we wear is an adaptation against climatic litions, but the heating of our houses is a very definite attempt to the effect of these conditions. The use of glasshouses for forcing ers and vegetables is also an example of a special method of overing existing climatic conditions. It may be urged in this connection man can increase temperature, but finds it more difficult to carry out reverse process. Here we are apt to forget the common use of the gerator ; the chilling of meat is the answer of man to the natural ioration of dead flesh caused by temperatures above freezing-point. ainage is an attempt to overcome the disadvantages of too much ture in the soil, whilst irrigation is the attempt to overcome the iencies of moisture, whether in the soil or as rainfall. It would seem, ver, that man cannot do very much actually to alter atmospheric itions. Experiments in high explosives would seem to indicate that has not very much power, at any rate at present, to induce the formaof clouds and the consequent rainfall. Nor is it proved that by creatarge bodies of water in arid areas, or by the planting of trees, man definitely increase rainfall. The precise influence which the planting ees has on atmospheric conditions is a large subject, but it must be ioned as an attempt of man to exert a modifying influence on natural tic conditions by which he finds himself surrounded.

important is the climatic factor in geography that no excuse is made ealing with it in some detail in the section which follows. Before passing on to the consideration of the climatic regions of the world, something must be said about the influence of climate in the formation of soil. The science of the study of soils, or pedology, is now a special and important branch of knowledge. The older geologists and geographers used to consider that the character of a soil depended very largely on the character of the underlying rocks. It is now quite definitely proved that this is not the case ; climate has a more important effect on the formation of soils than the underlying rocks. Thus in the Tropics, where there are alternating wet and dry seasons, a lateritic[1] soil forms almost independently of the character of the underlying rocks, whilst it is found, broadly speaking, that in those countries where the rainy season coincides with the hot season the formation of soil goes on rapidly ; whereas where the rainy season coincides with the cold season, as it does in Mediterreanean lands, the formation of soil is a very much slower process.

The three great factors which we have considered so far, topography, structure and climate, may be regarded as of equal importance. Consideration of the first two, and sometimes of a part of the third, formed what was formerly the domain of the subject of " physical geography." We no longer consider it desirable to keep these watertight compartments in geography, and we recognise that the study of the old physical geography is an integral part of all geography. It is a necessary basis which must not on any account be neglected.

Vegetation

We find that the first three factors make their influence felt, and are most readily observed, by their influence on the natural vegetation cover of the world ; so the fourth factor which has to be considered is the factor of vegetation. As we wander about the surface of the British Isles, we see in the bogs of Ireland and the dry heaths of East Anglia the reflection of both climatic and soil conditions. The great pine and spruce forests of Norway contrast with the pleasant homely oakwoods of southern England, and in their turn reflect differences in climate. We shall endeavour to show shortly that each of the great climatic regions of the world has its own characteristic type of vegetation, and this natural vegetation exercises a very important influence on the life and activities of man. It is necessary to notice here how very extensive has been the influence of man on natural vegetation. It might be thought that the difference between primitive and civilised man in this connection lies in relatively slight effects exercised by the former on the natural vegetation of his habitat, contrasted with the enormous effect of the latter. This is not entirely the case, since primitive man tends to destroy without replacing ; civilised man to destroy with the object of replacing. In Tropical regions, especially in Asia and Africa, huge areas of valuable forest have been burnt by native cultivators to yield the small patches of cultivated land which are only used for two or three seasons, whilst the pristine richness of the soil remains. In more densely populated temperate lands (*e.g.* Britain) it is doubtful whether any extensive tracts of true natural vegetation remain. It might be held therefore, that vegetation is no longer a

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[1] Latin, *later=a brick*—so called from the cellular character of the soil and its red-brown colour, which is due to iron.

ant factor in determining the activities of man. It is true that the
in no longer hunts the bison over the wide prairies and the cowboy
a Ford rather than a broncho, but much of the natural vegetation
till remain. Of still greater importance is the fact that the factors
limit the growth of natural vegetation still exert their limiting in-
e on vegetation improved by man. So that, in turn, the " artifi-
vegetation influences and to a large extent determines the activities
n. The grass of the Canadian prairies has given place to the man-
ved grasses, the cereals, but the cultivation of these cereals exerts
rmous influence on the life of man in these regions.

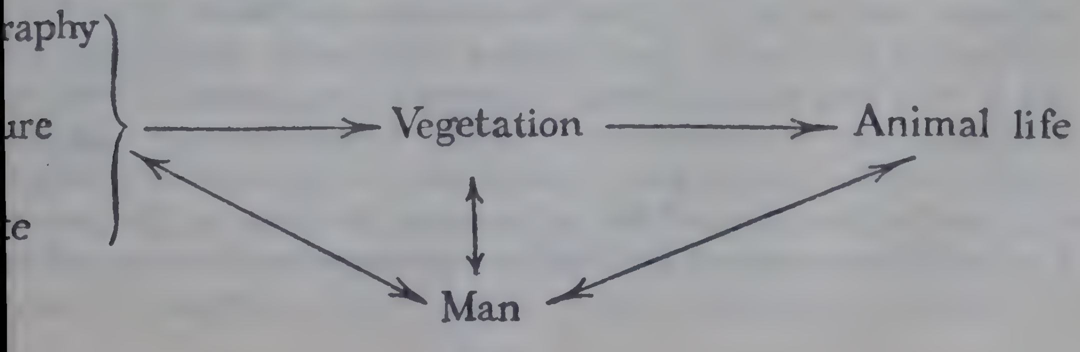
netimes man upsets the natural balance in the plant world, with
rous results. The grasses of New Zealand have been largely replaced
more nutritious pasture grasses of England, but the introduction
succulent prickly pear into Australia to provide fodder in the
racts has resulted in the invasion and destruction of richer areas
at is now a serious pest. The water-hyacinth was brought to grace
ornamental waters in India, with no thought that a few years later
penditure of thousands of pounds per annum would be involved
ring it from navigable streams.

Animal Life

as the joint influence of topography, soil and climate is expressed
natural vegetation, so is the character of the latter expressed in
imal life. The monkeys are obviously adapted for life in forests,
telopes for an existence on wide plains, the polar bear for life in
wastes. Similarly vegetation exerts its influence on animals
ticated by man—as the concentration of sheep on the temperate
nds of the Southern Hemisphere bears witness.

character of the native animal life is obviously of the greatest
tance to primitive man who is still a hunter. In the civilised
n world the trapper must scour the northern forests and tundra,
g-game hunter seeks his prey in appropriate regions. While these
ces on modern man are obvious, we are apt to forget the more
cant rôle played by humbler creatures. The tsetse fly belt in Africa
fies modern science and limits areas of settlement ; the conquest
malaria-carrying mosquito is still but partly accomplished. A host
ases still compel man to move warily and take adequate precau-

summarise, the relationship of the geographical factors of the
ment to man may be expressed diagrammatically thus (reversed
representing reciprocal influence) :



It may be observed that man should properly take his place amongst the animals in the way in which he is influenced by the other factors, but as an animal capable not only of taking thought but also of taking action accordingly, he stands almost alone.

Enough has been said to indicate the logical order in which the geographical factors should be considered when studying the geography of the world or of individual tracts. In the first place, it is desirable to study the world as a whole and then to proceed to a study of definite regions. Many, if not most, modern school and university courses comprise these two aspects, each forming a part of the work : the first forming "World Geography," the second "Regional Geography."

We will consider in somewhat greater detail the climatic factor.

III. THE MAJOR CLIMATIC REGIONS OF THE WORLD

Reference has already been made to the enormous influence exerted on man and his activities by climate. One of the most valuable conceptions of modern Geography is that of climatic regions. It is found, for instance, that the climatic conditions characteristic of the countries surrounding the Mediterranean Sea are found also in part of the North American continent, in California. Almost precisely similar climatic conditions are again found in central Chile in South America, in the neighbourhood of Cape Town in South Africa, as well as in parts of Western and South Australia. In these regions there is often a very marked similarity in the natural vegetation. Still more important, agricultural methods which have been proved to be suitable to one of these regions will, economic and other conditions being equal, prove equally suitable in any one of the other regions. Again, the products of one area can be made also the products of the other areas in the same type of climate. A crop which flourishes in one of these Mediterranean regions, as they are called, may be expected to flourish equally well in any one of the others. We need but to watch the shop front of the nearest fruiterers' to see, during the year, oranges from Spain, from California, from Cape Province in South Africa, and again from Australia. It can be realised from this how the modern world has made use of regions that have a similar climate.

The division of the world into major natural regions on the basis of climate is due very largely to the late Professor A. J. Herbertson, and it is indicative of the youth of modern geographical science that Herbertson's famous paper to the Royal Geographical Society was only presented in the year 1905. Although he modified his general scheme o divisions, and although there are several schemes of world climatic divisions now in use, the principle remains the same. What one author may regard as a major type, another will merely regard as a sub-type, and so on ; but actually there is surprising agreement, rather than disagreement, on the subject as a whole. Consciously or unconsciously, major climatic regions play a large part in the troubled political and economic relationships of the countries of the world at the present time This is because some of the leading raw materials of commerce can onl be produced in regions with a certain type of climate. Thus Russia

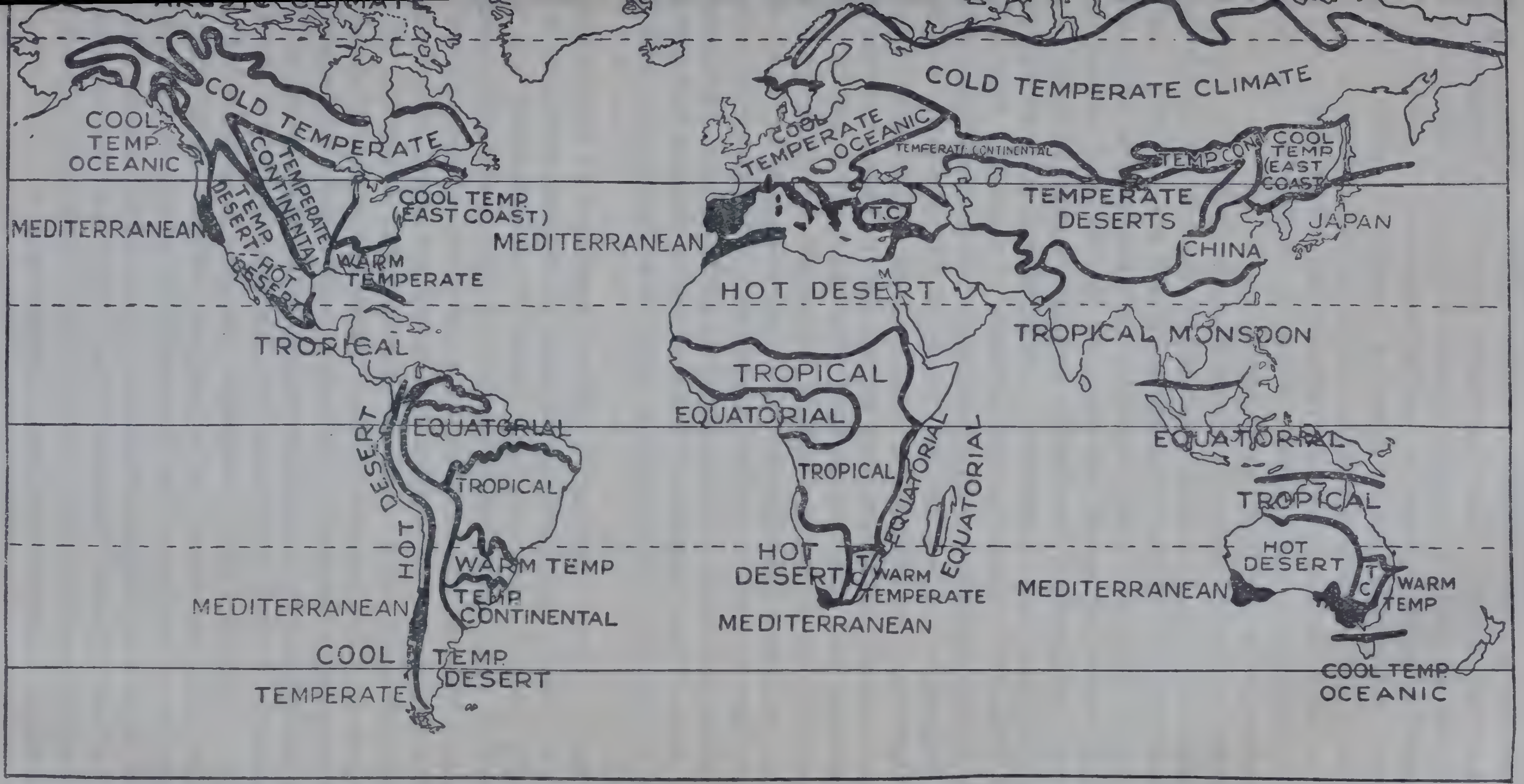


Fig. 1. Map of the world, showing a division into major climatic regions: the fundamental conception in modern geography.

despite her 8 million square miles of territory and her 150 millio inhabitants, is unable to produce within her own territories any of thos products which require an essentially tropical or equatorial climate She must depend on outside sources for her requirements of suc products as rubber, cocoa, tea, coffee and spices. Three million squar miles of continental United States of America lie entirely outside th Tropics ; so that although America is the largest consumer of rubbe in the world, she must get that rubber from outside her own territory Even her Tropical possessions, notably the Philippine Islands, only g a short way towards fulfilling requirements.

There are other ways in which the conception of major climati regions is important. Much agricultural research in Canada has bee directed towards finding a wheat which will ripen rapidly, and so ca be grown in the northern latitudes of Canada, where the summer though warm and bright and ideal for the ripening of cereals, is to short for existing varieties of wheat. Any result obtained by the Canadian in this respect can be immediately utilised for the steppe-lands of Russi and Siberia. Or again, in the problem of migration and settlemen as Japan has found to her disappointment, it is little use offering facilitie for settlement in the wide open plains of Manchuria to the Japanes who hates the long bitter winter. Still less can Canada hope to provide home, even supposing she were willing, for the Indian cultivator whos native land is already overcrowded. On the other hand, the spectacl of overcrowded India and China, separated by underpopulated bu equally desirable Indo-China with a climate equally suitable for settle ment either by Indians or Chinese, provides a background for the stud of existing racial and political problems in the countries of Indo-Chin The major climatic regions of the world, their character and distributio their products and potentialities, must therefore be discussed in som detail.

About a dozen well-marked climatic types can be distinguished, bu naturally the actual divisions between the regions are not, as a rul sharply marked lines. One type tends to fade gradually into anothe and often considerable tracts can best be regarded as transitional area Further, there is obviously considerable variation between one part a climatic region and another part. Local variations, due especially topographical features, notably elevation, are found in all region The major climatic regions are given names in keeping with their gener character, but so marked is the influence of climate on vegetation, th a climatic type is often named after the prevailing vegetation Thus th Temperate Continental Climate is called the Temperate Grassland, Prairie, type, the Cold Temperate Climate is called the Coniferou Forest type, and so on. Other authors prefer to name their climat types after the regions where they are found in their most characterist form. Thus the Tropical Grasslands are so characteristic of Africa th one can easily justify the name “ Sudan type.” But the matter of fund mental importance is the character of the climate itself, hence it seen desirable to maintain the use of climatic names.

The Equatorial Climate

ie Equatorial Climate, as its name implies, occurs in the belt on r side of the equator, extending roughly between 5° N. and 5° S., occupying a tract about 600 miles in width almost encircling the of the globe. Frequently the Equatorial type extends further north south than this, but the extreme limits may be regarded as about N. and 10° S. of the equator. Its most typical development is in the of the Amazon, hence the name "Amazon type." The characteristic ation is tall, evergreen forest, hence the descriptive name, the te of Hot, Wet Forests or Selvas. The temperature of the Equatorial s high throughout the year, and has but a very small variation. In ypical localities the average range is between 78° F. and 80° F.; ange between the hottest and coldest months is rarely more than Similarly the difference between day and night temperatures is , and may be taken as, typically, less than 20°—frequently less than In these regions the rain falls at all seasons of the year, and there is y season except in a strictly relative sense. In very many cases is a daily routine of weather which is particularly interesting. The morning is frequently misty, but by 8 or 9 o'clock the mists have peared and the sun shines strongly till midday, thus causing rapid ration and upward currents in the atmosphere. The ascending ure-laden air becomes cooler and clouds form; the formation of s in the afternoon and the subsequent downpour of rain are fre- ly accompanied by thunder. The rain falls in the latter part of the oon in a torrential downpour usually of short duration. The pean living, for example, at Singapore must pay attention to this routine. His early morning walk takes advantage of the mist that the fierce rays of the sun, which can better be borne in the coolness office building. It is true that every two or three days out of four rangements for an afternoon tennis party or round of golf will be by the afternoon storm, but there is almost sure to be the joy of er-dinner car drive by the light of the clear, starlit night. Although alls throughout the year in Equatorial regions, it is frequently that there are one, or two, periods of maximum rainfall. Places he equator usually have two maxima; stations on the more northern thern fringes of the belt, usually one. In most places the rainfall num, or maxima, occur shortly after the period when the sun is l. The Equatorial regions are essentially regions of heavy rainfall. infall for the year ranges from 70 or 80 inches upwards. The areas from the influence of the sea and a ready supply of moisture, s the interior of the Congo Basin, may have rather less. It is a r fallacy that the nearer one gets to the equator, the hotter it es, and that the Equatorial regions are the hottest in the world. erage temperature, it is true, is uniformly high, and the constantly atmosphere is enervating; but the Equatorial climate is far from he most trying in the world. The thermometer rarely rises above '., and the relatively cool rains which accompany the afternoon rstorms make the climate distinctly pleasant. This is particularly

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[1] Fahrenheit degrees are used throughout this Article.

the case in maritime situations such, again, as the island of Singapore, where land and sea breezes impart a welcome movement to the air. The climate is found at its worst in the interior of the great Equatorial forests, where the air is absolutely still. Perhaps the most characteristic feature of this type of climate is the absence of seasonal change ; all the time a man remains in good health the climate can be described as a pleasant and by no means unhealthy one. But let his health fall for a short time below par, and the absence of change renders recuperation extremely difficult. Hence the need for hill stations, or for a trip home, for the European who has had the misfortune to get run down.

The ever wet, ever hot climate of Equatorial regions produces a very rank luxuriant vegetation. There is fierce competition, not for moisture, but for light and air. In that most characteristic region, the Amazon Basin, the whole country is clothed with an evergreen forest of giant trees. These hot, wet forests contain a great variety of trees, and it is rarely that more than two of the same species are found in the space of an acre ; but they are nearly all alike in having tall, unbranched boles, with a crown of leaves at the top, forming a close, interlacing mass so thick that sunlight never reaches the ground, and the interior of the forest is gloomy and lifeless in the extreme. This gloomy, vault-like type of Equatorial forest is almost restricted to South America, for in Equatorial Africa and Asia the forests are more open. Although nearly all the trees have short periods during which they shed their leaves, the shedding periods of the different species come at different seasons, and thus the forest is never bare of leaves. The trees are nearly all hardwooded species ; so rare is softwood in the forests that Manaos, in the heart of South America, imports its building timber from the temperate regions in North America. The struggle for light and air, which are of course only to be found above the tree-tops, has resulted in the existence of large numbers of woody climbers or lianas. The trees climbed may afterwards die and rot away, leaving the great coils of the climber pendulous from the height above and forming tangled, impenetrable masses on the ground. Ferns, and flowering plants such as orchids, may find a foothold on the higher branches of the trees and thus reach the much-desired light and air. So in the dense forests of South America the ground is almost devoid of living plants, and is covered with a mass of decaying vegetation This is more particularly the case when the Amazon tributaries overflow their banks and cause wide morasses. In the more open forests of Africa and Asia there is a luxuriant ground vegetation of broad-leaved herbs. In the denser forests it is scarcely surprising that animal life is almost restricted to the tree-tops, and nearly all orders of the animal kingdom can exhibit members especially adapted for such a habitat. The monkeys are good examples amongst mammals ; the tree-frogs, with their sucker-like feet, are striking examples amongst the lower orders.

The denser Equatorial forests have been described as " regions of debilitation," since the dense vegetation causes man to degenerate ; such forests are very sparsely inhabited by backward races, stunted both physically and mentally, of which the American-Indian tribes of the Amazon and the pygmies of the Congo are outstanding examples. The latter attempt to emulate the other denizens of the forest by building their itive homes high up in the trees, away from the damp and unhealthy nd. The more open Equatorial forests, where clearing is easier and ure is bountiful in her gifts, are the home of many sturdy if somewhat races. Of these the Malays, the Javanese, and the Dyaks of Borneo ood instances. There are certain marked difficulties in the clearing of atorial forests and the economic development of the countries. The are of extremely hard wood, very difficult to cut down and even ult to burn. On the other hand, when once the forest is set alight, rees do not recover. A great danger is the rapidity with which vegen springs up on cleared land, so that crops rapidly become choked by boo and rank grass. Thousands of square miles of valuable forest were oyed by native clearing in Africa and Asia, and are now occupied only seless bamboo and thorny thickets. Another danger in clearing Equal forests, especially on hillsides, is that when the trees have been ed away, the torrential rains will completely wash away the soil and but the bare rock. It has been well said that the Equatorial climate ad master but a good servant. To the South American-Indians, or to ygmies of Africa, it is a master ; to the European who succumbs to btle influence it may also be a master. But when Equatorial forests been successfully cleared and plantations well established, the ns are extraordinarily productive. For instance, several crops of rice ear may be obtained from the same field. There are no seasons, and -time may be arranged at the pleasure of the cultivator himself. ngst the leading products of Equatorial regions, the development of h is due mainly to European enterprise, may be noted rubber, palm ocoa and sugar. Of these the modern rubber of commerce is entirely, nost entirely, restricted to regions which have an Equatorial type of te. Nearly all the rubber of commerce is now obtained from the rubber tree. A native of the Equatorial forests of the Amazon, after difficulties the tree was introduced into Malaya and India. The duction was carried out *via* London, where in the hothouses of Kew eeds from South America were germinated in 1876 and the young s sent to Ceylon. It is interesting to notice that the plants which sent to Calcutta, where, although there is a heavy rainfall, there is a dry season, were not successful. Calcutta remains outside the sphere rubber can be cultivated with advantage. The wild rubber of l and the Belgian Congo is now very unimportant, and the bulk of orld's supplies is obtained from the plantations of Ceylon, Southern , Malaya and the Dutch East Indies. The limits of the Equatorial re roughly the limits where profitable rubber cultivation is possible. other interesting Equatorial product is cocoa, obtained from the or beans of a large evergreen tree, the cacao-tree. The beans appear s inside large pods, which grow from the stem of a tree. The tree is d in distribution to sheltered lowlands with a high temperature and l-distributed rainfall. All countries with an Equatorial type of e are, broadly speaking, suitable for cocoa cultivation ; more than irds of the world's total cocoa before the War came from Cennd South America. Now half comes from the Gold Coast—an le of how economic conditions can shift the main centres of cultivaom one point to another of the same climatic belt, but no economic factors can remove the centres of cultivation outside the limits defined by the climate which is necessary.

From what has been said, it will be seen that there is at the present time a marked contrast between : (*a*) the undeveloped Equatorial regions, such as the Amazon Basin and part of the Congo Basin, which are sparsely inhabited and very little used, yielding only a little wild rubber or ivory, and (*b*) the developed regions, where development is the result of the enterprise of the white man, partly with the aid of local labour, partly with coloured labour from other regions. The most highly developed tracts are Malaya, including the Federated Malay States and Straits Settlements, and Java ; but the development is spreading rapidly to Sumatra and the other islands of the East Indies, and also to parts of the Congo and to the coastal lands of Guinea in Africa. Indeed, development is proceeding along the fringes of all areas; the region that is likely to defy man's activities longest is the heart of the great Amazon Basin.

The Tropical Climate

The word " tropical " is commonly used in such a loose way that it conveys little more than the idea of heat. But geographers have attached a more precise meaning to the Tropical Climate, which is found typically within the Tropics and on either side of the Equatorial Belt. One particularly extensive area is in the Sudan of Africa, hence the name of the " Sudan type." In this typical central portion the vegetation is all grassland, or grassland with scattered trees, and hence it is sometimes called " Tropical Grassland Climate " or " Savana Climate." By contrast with the Equatorial Belt, there is in the Tropical Climate a marked difference between the temperatures of the hot and cool seasons of the year. Towards the equator, or in maritime situations, where the rainfall is heavy, the difference in temperature between the hottest and the coldest months is but small. In the drier parts of the belt there is frequently a difference of more than 30° between the average temperatures in the cool and hot seasons. The difference between day and night temperatures is correspondingly marked.

Great tracts of Tropical grassland lie between the Equatorial forests on the one side and the hot deserts on the other ; and there is every gradation in rainfall, from 70 or 80 inches or more on the forest edge to about 15 inches on the desert border. In some of the wettest stations in the Tropical Belt, the rainfall may be as much as over 200 inches per year. There is, however, a distinctly dry and a distinctly wet season. It is usually possible to distinguish three seasons—a cool, dry season, followed by a hot, dry season when the land becomes greatly heated and the highest temperatures are recorded. In the northern hemisphere the hot season terminates about April or May; then come the rains, with corresponding cooling of the atmosphere. It becomes slightly hotter again towards the end of the rainy season, before the cool season sets in. The rain falls in the spring and summer of the year, while the winter months are practically rainless. It is the season of intensive rainfall which favours the growth of grass; trees tend to require a constant supply of moisture throughout the year, and those months which are rainless militate against a dense growth of many species of trees. Grass, on the other hand, s up where moisture is available and has a resting period in the cool as well as in the very hot months which precede the rains. Ac- we can distinguish several types of vegetation in regions having a cal Climate. Near the Equatorial Belt, provided the rainfall is suffi- heavy, there is forest differing but little from the Equatorial forest. the rainfall drops below about 60 or 80 inches, this passes into in which the trees are deciduous, losing their leaves, that is to say a resting period, during the heat of the year. Then comes the most teristic belt—the great stretches of grassland, with occasional he savana or parkland of Africa. Towards the desert borders this tion becomes poorer, the grass is coarse and stunted, the trees spiny bushes, till the whole fades into the great desert. In the arts the reliability of the rainfall from year to year is important; e years the fall is sufficient to ensure good crops, whilst in other poor rainfall results in famine conditions. In the drier parts of the al grasslands, therefore, we find some of the great famine belts of rld.

animals of the Equatorial forests are especially adapted to climb- occupation which would be of little use in grasslands, where there stead, two main groups of animals : (*a*) the swift-footed, vegetable animals, such as the antelope and giraffe, which find safety from emies in flight ; (*b*) the carnivores, such as the lion and the leopard, prey upon the members of the first group. Man in the savana is ily a hunter ; but just as the grasslands support vast herds of wild, ating animals, so man is able to rear great herds of cattle, and es then a pastoralist. The natural grasses which flourish in the s may be replaced by the cereal grasses, and so man may become an turalist. The great Tropical grasslands cover enormous areas in at wo of the continents. In South America there are the llanos of ela, the campos of Brazil ; in Africa, huge tracts are covered by al grassland; in north Australia there is again another huge area. any, of the Tropical grasslands are yet fully developed. Above all, e lands of the future. In the Temperate grasslands of the world, will be discussed later, there is at present a war between bread and nd as wheat displaces cattle in these lands, herds are likely to more and more important in the Tropical grasslands. In some e natural grasses are too coarse to be of immediate use ; but there t areas at present uninhabited or only thinly inhabited, such as rn and Southern Rhodesia, Angola, the East African Highlands rthern Australia, which would make very productive country. ture is likely to follow, maize and millets amongst the cereal crops, nd sugar amongst others, as well as groundnuts and many other . It is interesting to notice that many of the companies which own in South America, and find competition for the land there g severe, are taking up concessions in Africa. There are great ies, it is true, in the way of the development of many of these ne at least is the shortage of labour. Few parts of the grasslands of arry a population of more than 20 to the square mile, while the ds of northern Australia may be described as absolutely unin- Communications are often virtually non-existent. It is useless raising cattle in northern Australia if the railway is lacking which ca take the fattened cattle to the coast ports ; for cattle which have bee driven hundreds of miles to the slaughterhouses arrive mere skin an bone, of value for their hide and nothing else. Settlement will follow th railway, which must be the pioneer. This is already happening with th new railway across Angola, in West Africa. Politically, it is almost certai that pressure will be brought to bear in the near future upon thos nations who have control of these great tracts of undeveloped land, tha they may develop them for the benefit of mankind as a whole. Th question at present is how far the climate is suited to settlement by whi men, and how far these lands must be developed by coloured races, eithe with or without European supervision.

The Tropical Monsoon Climate

The Tropical Monsoon Climate is very similar to the Tropical, thoug the rainfall is caused in a different way. Both types are found main within the Tropics, both have wet summers and dry warm winters ; bu whereas the rainfall in the Tropical grasslands depends on moistu brought from the sea by the normal trade wind system, the rainfall i Monsoon lands is caused by a complete reversal of the normal win during the rainy season. During the hot season in the early part of th year the land becomes greatly heated and gives rise to an area of low pre sure. The air rises, and cool, moisture-laden winds from the ocean flow i to take its place, bringing with them the life-giving rain on which th Monsoon countries may be said to depend. The typical Monsoon lan are India, Indo-China and southern China. Central and northern Chi and Japan are often called Monsoon lands ; the rainfall is due to simil causes, but they lie outside the Tropics, and have distinctly cold winter thus necessitating their separation from Tropical Monsoon Lands. I India, which may be regarded as *par excellence* the typical Monso land, there are three seasons : the cool season, with little rain, lasti from November to about January ; the hot season, when the land becom heated up and there is no rain, from January to about the middle June ; the rainy season, when the heavy rains cool the atmosphere a temperatures are lower, from about the middle of June to Octobe Generally speaking, the drier the place, the less the cooling influence the rain is felt and the greater the range of temperature, as in the Punja and the north-west of India generally. The wetter places, on the oth hand, are those under the influence of the sea, and they have a small range of temperature. Of these, Bombay is a good example. The actu rainfall in Monsoon lands varies enormously ; where the Monsoon com in contact with high mountains near the coast, and starts to rise, the r sulting rainfall is very heavy indeed, and can be as much as 500 inches year, so that those positions may be classed as the rainiest in the world. C the other hand near the low pressure areas in India, towards which t winds blow for great distances over land, they arrive practically dry ; a certain stations have less than 5 inches of rain per year.

The natural vegetation and the crops which are possible vary ve widely according to the amount of moisture available. Broadly speakin Monsoon lands are conveniently divided into four parts :

Areas with more than 80 inches of rain a year. These are mainly ed with evergreen forest of Equatorial type, and in these tracts rice staple food grain of the people and is often almost the only crop *bare Fig. 2*). The danger here is not lack of water, but flooding, protective works are usually necessary to prevent disastrous floods; or example, in the delta of the Irrawaddy.

Areas with between 40 and 80 inches of rain per year. These are where the deciduous Monsoon forests flourish, the trees losing their s in the hot dry season. Here rice is again the usual food grain *Fig. 2*), but it requires to be protected against possible drought. irrigation works may be classed as protective, rather than essential. e, sugar and oilseeds are other crops characteristic of this interate belt.

Areas with between 20 and 40 inches of rain per year. These are ally covered with scrubland and thorn forest. Thus the true Mon- forest, in which such trees as the teak are especially important, with decreasing rainfall into a woodland of small, thorny trees. trees are separated often by bare patches which may, during the , become covered with a rich growth of grass, and in this season crubland of India closely resembles the savana or tropical grassland frica. In this dry belt millet is the staple food grain of the people *Fig. 4*), except where wheat (*compare Fig. 3*) and barley are grown nter crops, as in the cooler, drier regions of northern India. Sesamum various oilseeds are important, and cotton is also a characteristic of these drier parts of the Monsoon lands, which are, however, cularly famine areas, because the failure of the Monsoon brings ainfall below the limit essential for successful cultivation. Hence mportance of irrigation works.

Areas with less than 20 inches. These form desert and semi- t, where irrigation is essential for the cultivation of almost any crop. e semi-desert the vegetation is a scrubland, with a few scattered y or succulent plants.

onsoon vegetation is more easily cleared than Equatorial forest, once the land is cleared a comparatively small effort on the part of procures an abundant return, whether it be in the wetter tracts or in rier. Accordingly the Monsoon lands are amongst the most densely lated of the world, the population tending to be largely agricultural concentrated in those areas where the soil is richest. The Monsoon of India alone has a present population of over 320 million people, of n nearly 90 per cent. depend for their existence on the products of oil. The Monsoon climate occurs, as we have noted, in India, Burma ndo-China, and south China, but in other lands, especially round the n Ocean, notably on the north-west coast of Australia, and part of ast African coast, climatic conditions are very similar. The Monsoon is also found on the coastal margins of the north-west of South ica and Central America, where much of the heavy rainfall might escribed as "monsoonal." It will be seen that of the Monsoon India proper and southern China are very densely populated; may, d, be described as over-populated. Between these two are the com- ively under-populated countries of French Indo-China; Burma, a province of India; and Siam, an independent kingdom. There is very great Indian immigration to Burma, where the lazy, likeable Burma cultivator is no match for the Indian. Siam and French Indo-China are scenes of peaceful Chinese penetration ; but of greater importance in the future are the distinctly undeveloped Monsoon lands. Conditions along the north-west of Australia and along the east coast of Africa are sufficiently similar to those found in India to prove an inevitable attraction to Indians. Indian agriculture, as far as crops are concerned, could be applied to a considerable part of uninhabited northern Australia, though heaven forbid that the agricultural methods and treatment of land should likewise be applied *en bloc*. When the time comes for the development o this great area of northern Australia, the lessons learnt in India will be invaluable. It is scarcely too much to hazard that in the dry, light soils o north Australia the oilseeds, particularly perhaps the groundnut, wil prove a salvation as they have done over much of the Dry Belt of Burma But the geographer cannot do more than point to the potentialities of the region ; other factors must decide when and by whom these lands are to be developed.

The Hot Desert Climate

The Hot Deserts lie on the poleward side of the regions with a Tropica climate. They are confined to high pressure belts where the currents o air are descending and the winds blow outwards, so that there are no moisture-laden winds coming in from the ocean. They occur mainly on the western side of the land masses, because on the eastern side a certain amount of rain in the same latitudes would be brought by the trade winds There are few clouds, and the sun pours down with unmitigated force on the unprotected soil, while the absence of cloud also permits rapid radiation of heat and the nights are often very cold. There is a big contrast between the hot season, when the sun is vertically overhead, and the cold season. There is little or no rain to exercise a cooling influence on the temperature. Then many of the deserts are low-lying, so there is not even altitude to temper the heat of summer, with the result that the highest temperatures in the world are recorded in these regions. Thus Golea in the Sahara, has an average temperature of only 39° in January and of 93° in July—a range of 54° between the hottest and the coldest months Similarly Jacobabad, in the north-west of India, ranges from 57°, an average temperature for January, to 98° F. as the average temperature in June. On the margins of the desert nearest the equator, the desert fades into semi-desert as soon as the rainfall reaches 9 or 10 inches. Thus Timbuctoo has a total rainfall of 9 inches, and can be considered as a very dry portion of Tropical grassland. But it is really not until the rainfall reaches 20 inches a year that one passes into the Tropical grassland belt properly speaking. Near these margins, such rain as does fall in the desert comes mainly in the same season as it does in the Tropical climate that is to say, in the summer. On the poleward margins the desert fades gradually into Mediterranean scrubland, where rain comes in winter Cairo, with 1.3 inches of rain per year, is an example of this type. The land masses are broader in the northern hemisphere, with the result that the deserts are larger there than they are in the southern hemisphere. There reat continuous areas of desert stretching right across North Africa the Atlantic to the Red Sea. This Sahara Desert often gives its name e " Sahara type " of climate. The desert continues over Arabia to oorders of Baluchistan and the great Indian Desert. In North rica there are the deserts of the Mexican-United States borders ; in h America there are the Peruvian and north Chilean deserts, which oy the area between the Andes and the Pacific coast. In South Africa Kalahari Desert extends right to the Atlantic Ocean. In Australia a large area has a rainfall of less than 10 inches a year, forming the Australian Desert.

iere are few deserts where absolutely nothing grows ; the desert s have special means of storing water. Some of them have very long which go down to great depths and so reach water ; others have al stems and leaves in which water can be stored up, whilst nearly e armed with sharp spines and thorns to prevent their being eaten imals. From the point of view of natural vegetation, Hot Deserts really be regarded as falling into two divisions : (*a*) the portions g into Tropical grasslands, which are really very dry grassland ; (*b*) ortions bordering the Mediterranean regions, which are very poor land. Of special importance are the fertile areas or oases, usually oying hollows, where an underground supply of water comes iently near the surface to be accessible to vegetation. Some of these consist merely of a clump of palms surrounding a pool or well, and the typical tree is the date palm. Other oases are many hundreds of e miles in area and, being very fertile, support a large population. ough the deserts are so sparsely inhabited, the people fall into three os : (*a*) The wanderers who move about with their camels, their only s of transport, from place to place, and either act as carriers of goods one desert margin to another or form bands of nomadic robbers. he settled peoples of the oases who devote themselves to growing and rearing cattle, and also to the cultivation of the date palm. he settled population of miners attracted by mineral deposits independently of climatic conditions, as in the nitrate fields of Chile or the fields of Western Australia. The latter settlements are often re- d to as saxicultural settlements, those which are due to the presence neral or stone working. The influence of the desert environment on is of the greatest interest. The monotony of the scenery, the clear- of the sky and the need for guidance when travelling by night, have ntrated the attention on the heavens rather than the earth. So the t has produced peoples of philosophical outlook, as exemplified by ncient Egyptians and the Arabs, learned in mathematics and as- my. The larger oases of the desert, such as those in Arabia, have in a remarkable way as reservoirs of people ; they are capable of orting a large population so long as the water supply is available. If prings fail, the people are faced with starvation, with the result arge bands leave the oases for fresh lands and never return. The tions of the Arabs in the Middle Ages can be traced to such causes, n were also responsible for the arrival of the Shepherd Kings in t from Arabia and for the journeys of Abraham which led him to in the Promised Land. This factor is not without interest at the present day, as any student of the politics of Arabia can witness. Here again the difficulties of French administration in the great tract over which the French have dominance in North Africa are largely concerned with hereditary occupations of the nomadic desert dwellers. It is to be noticed that in many cases the soil of desert land is a fine alluvium; where water is available for irrigation the desert may become exceptionally fertile. The Nile valley in Egypt is a special example, as the river flows in a narrow trench-like valley, cut in the surface of the desert; but the crop lands of the Colorado Desert of America and the Indus Plain of India are characteristic examples of desert irrigation.

The importance of deserts as barriers to human intercourse and migration is also of particular note. The Sahara, separating the white and coloured races of mankind, is an excellent example. Apart from the saxicultural settlements and the larger oases that have already been mentioned, it is obvious that deserts can never support more than an extremely limited population. Those European nations which have desert colonies may appear on paper to have control over large tracts of land, but those large tracts are potentially of very little use. One of the best examples is over-populated Italy, possessing as it does a large tract of the Sahara Desert in Libya, in North Africa, and another large tract of mainly desert country in Somaliland. As far as extensive colonies for settlement are concerned, Italy might almost as well be without colonies; and her need for an outlet for her swarming population is one of the most serious problems that affect European politics, more especially becusea of the contrast with her neighbour France, who possesses a vast colonial empire suitable for development and settlement.

The Mediterranean Climate

One of the most distinctive and best-known of all the climatic types is that known as the Mediterranean, which is characteristic of the lands surrounding the Mediterranean Sea. Like the Hot Deserts which border them on the side near the equator, these regions are hot and dry in the summer with outblowing winds. In winter, however, they come under the influence of the westerly wind belt and so enjoy moist, mild winters. In other words, this is the winter rain climate, contrasted with the typical summer rain climate of the Tropical Monsoon. It must be remembered, however, that the Mediterranean is a temperate climate and very much cooler. One of the characteristics of the Mediterranean climate is the large amount of sunshine throughout the year. Almost cloudless skies are the rule in summer, and even in winter clouds are less numerous than would be expected. The Mediterranean climate is restricted to the western sides of the continents, where during the hot summer the trade winds are blowing off-shore. A little reflection will show that a Mediterranean type of climate could scarcely exist on the east of the continents; where the trade winds blow from the oceans and are moisture-laden; whereas the westerly winds blowing from the land would be rainless. The Mediterranean regions thus lie on the western sides of the continents between the latitude of 30° and 45°; the largest area is that found all round the Mediterranean Sea. Other areas occur in North America fornia), South America (central Chile), South Africa (south- ern Cape Province), and Australia (south-west of Western Australia, ı Australia and a part of Victoria).

turally there are considerable variations within the type, especially e large Mediterranean Sea area. There as one goes eastwards the rs tend to become colder ; but the coldest month has usually an ge temperature of over 40° and in very large tracts over 50°. The ners are both hot and dry, with a mean temperature in the hottest h of over 70°, and in many areas over 80°. The chilliness of winter is compensated for by the bright sunshine. The rainfall varies in nt, but the typical average is between 10 and 40 inches a year. In ex- l situations there is a very much heavier fall. In this climate of moist rs and hot, dry summers, the plants need to ultilise the water which nulates during the winter, and to protect themselves against lack oisture during the summer. The climate does not favour shallow- d herbs and grasses, which require light showers during the spring early summer. The vegetation of the Mediterranean lands consists fore mainly of evergreen trees and shrubs, with a ground vegetation wering shrubs and herbs to take the place of grass. Many of the os and trees have small leathery leaves or leaves with a coating of o retain the moisture ; others, such as the olive, have leaves covered fine silky hairs. All these devices prevent excessive transpiration. of the plants, such as the vine, have exceptionally long roots. In the r parts of the Mediterranean lands fine forests may occur, of which ork oak and the chestnut forests of Europe and the jarrah forests of alia are examples. The thick bark of the cork oak is itself a protection st loss of moisture. The dry summer conditions of these lands are for the ripening of fruit ; typical examples are the citrous fruits— es, lemons, and grapefruit—a great variety of deciduous fruit, rine, apricot, peach, pear and apple, as well as the olive, almond, fig, erry and vine. Of grains, certain types of wheat and barley grow well, g been adapted by man to the exigencies of climate. A little reflection eveal a certain incompatability between the desirable sunny summers ripening of fruit or grain and the undesirable lack of moisture which en goes with it. Hence it is pre-eminently in Mediterranean regions rrigation by water from snow-fed mountain rivers plays a very large n economic development.

e climate of Mediterranean lands, favourable to man and plants has harboured many of the great civilisations of the world—Greece Rome, Crete and Carthage. But perhaps the ease of living and the of *laissez-faire* engendered by the climate have resulted in degenera- There is a tendency for the people to become lazy and too easily nted, and during the hot summer the attraction of the noontide is too strong to be resisted. The Mediterranean regions are, how- definitely regions which favour a considerable population. Thus in America and Australia these regions have been very considerably oped. Similarly the Mediterranean region of South Africa was not he part of the continent first settled by the Dutch, but it remains a important part. We do not need to be reminded either of the pro- of California.

Most of the leading Mediterranean products are to be found in each of the regions concerned. The vine flourishes in the similar climatic regions of each of the continents ; and so there is the rivalry between the dried grape, the raisin, of Europe on the one hand, and California, South Africa and, more recently, Australia on the other. California no longer produces wine, but all the other regions do. Of recent years there has been more rivalry between four of the areas, Europe, California, South Africa and Australia, in the matter of the citrous fruit. It is not very long since oranges were definitely associated with Christmas and the winter season in England ; but the development of the Mediterranean lands in the southern hemisphere, where the seasons are the reverse of those in England, has put oranges on the European market throughout the year.

The Warm Temperate Climate

The Mediterranean climate is to be found on the western sides of the continents ; on the eastern sides in the same latitudes there are regions in which temperatures are roughly comparable but the rainfall comes mainly in summer. The regions now to be considered are the very important south-eastern states—the cotton lands—in the United States of America, the greater part of China, in Asia, the south-eastern coast lands of Australia and South Africa, and the region of Uruguay and south-eastern Brazil in South America. These regions have not a single type of climate in the sense in which the Mediterranean has a single type. Each region is influenced by the major physical features of the individual areas. The southern-eastern States have a well-distributed moderate rainfall throughout the year, usually with a maximum in the latter part of the summer, when the rain-bearing trade winds from the ocean flow in towards the low pressure areas created by the heat in the interior of the continent. The economy of this region is almost entirely bound up in the production of cotton, and it is interesting to note the northern and western limits of cotton cultivation. The northern limit can be defined by the length of the summer ; cotton must have 200 days between the last frost of spring and the first frost of autumn. Westwards the rainfall provides the limit, and between 20 and 23 inches is now found to be the minimum necessary for the cultivation of cotton, unless of course irrigation is available. Central and northern China form part of the great Monsoon region of Asia. The climate differs from that of India and southern China in the coldness of the winters. The rainfall, like that of India, is due to the development of a low pressure centre, towards which rain-bearing winds from the ocean blow. While India is protected in winter from the cold winds by the Himalayas, China is not so fortunate. Bitterly cold winds blow outwards from the heart of the land towards the sea throughout most of the winter bringing the temperature over much of the country down to freezing-point or below. The temperature of Peking is well below freezing in January. Snow falls commonly over the greater part of central and northern China. The summers, however, are both hot and wet, favouring the growth of rice in the south, whereas millet and wheat are the principal grains further north. Cotton is a leading crop in central China. In the three continents of the Southern Hemisphere, climatic conditions in sponding regions are somewhat similar, and sometimes one refers e "Eastralian" type of climate, which is that found in eastern alia. The rainfall is well distributed throughout the year, with a ner maximum derived mainly from the trade winds. But the southern nents are not broad enough to develop large high pressure centres in r with cold out-blowing winds; so the southern regions are much temperate and have very much milder winters. Though the natural ation varies from country to country in the Warm Temperate cli- high forest is typical: evergreen where the rainfall is sufficiently distributed. These "Warm Temperate Rain Forests" often exhibit a iance of growth rivalling the Equatorial forests, but they are more Palms and tree ferns are noteworthy in many areas. In the Gulf s there are both broad-leaved forests and coniferous forests, from the well-known pitch pine is obtained. China has been very exten- cleared of her natural vegetation, so that it is very difficult to know was the original forest cover. It should be mentioned that Japan sses this type of climate, but in her case the conditions are modified position of the country as an archipelago. Sufficient has been said to ate that these regions are eminently suited for human occupation and opment. The valleys of central China, with their rice, cotton, tea and resemble Monsoon India, or rather exceed it, in their density of lation, and include the most densely populated agricultural tracts whole world. The density may be upward of 3,000 to the square —3,000 people who find their sustenance throughout the year from mall tract of land afforded by one single square mile. The Gulf s of America are the world's storehouse of cotton with the Maize mmediately to the north. The eastern coastal strip of Australia and varm coastal belt of Natal have both attracted a large population. e are considerable untouched forest areas, however, in South rica—untouched largely because they are swampy and unhealthy.

The Cool Temperate Oceanic Climate

turning now to the western margins of the continents we must con- the climate found on the poleward side of Mediterranean lands, and ome to the regions which include the British Isles in Europe and astlands of British Columbia in North America. These regions lie antly in the belt of the westerly winds—the Anti-Trade wind belt— are under the influence of cool, rain-bearing winds from the ocean hole year. The two characteristics, small range of temperature een summer and winter and a well-distributed rainfall throughout ear, are at once obvious. The westerly winds do not blow as steadily trade winds, but rather as a succession of eddies and whirls known graphical speech as cyclones and anti-cyclones. Residents in north- rn Europe know well the prime importance of the cyclones or anti- nes in determining local weather conditions. The largest area having ype of climate is north-western Europe, but British Columbia and orth-western United States are another important area. In the ern Hemisphere there is only a small tract in southern Chile, and rt of Africa lies sufficiently far south, whilst in Australasia only

Tasmania and New Zealand (especially the South Island) are typical. In Europe, owing to the drift of warm water which is the continuation of the Gulf Stream, the mild winters characterising this type of climate extend exceptionally far north. Conditions are most truly oceanic, that is, the annual range is least, near the western coasts. The winters become steadily colder as one goes eastwards and the summers slightly warmer ; so it is customary in Europe to distinguish two sub-divisions :

(*a*) The north-west European type, where the average temperature of the coldest month is above freezing—averaging about 40°.

(*b*) Central European type, where the average temperature of the coldest month is about or below freezing.

The temperature for the hottest month lies between 50° and about 75°, with 65° as an average figure.

The rainfall is well distributed throughout the year, but the total amount varies somewhat widely. In the west the mountains are the wettest part, the plains, lying to the east of the mountain ranges, are the driest. Some parts of the British Isles have a rainfall of over 80 inches, as in the Lake District, whilst in the east of England the rainfall drops to little over 20 inches, and is as low as 18 inches in eastern Germany.

The Cool Temperate Climate is the natural home of the Temperate Deciduous Forests. In Monsoon lands the trees lose their leaves to protect them against the heat of the hot season ; but in the Cool Temperate lands the trees are bare during the winter as a protection against cold. The delicately tissued leaves are easily injured by winter frosts, and the trees have made the winter their resting period. The very name of the "fall" of the year, though replaced in England by the less descriptive "autumn," is indicative of the marked nature of the phenomenon of leaf fall. Many of the trees of these deciduous forests yield valuable hardwood timbers, more easily worked than the timbers of Equatorial lands, but hard relatively to the softwood timbers of the coniferous forests. Well-known examples are the oak, elm, maple, beech and birch. Deciduous forests formerly covered most of north-western and central Europe, only interrupted by highlands clothed with evergreen forests or with tracts of moorland and heathland. In North America the mixture of several species of evergreen conifers gives the forests a somewhat different aspect.

The Cool Temperate type is the one most favourable to the development of the human race. It is sufficiently cold to necessitate manual work for the maintaining of bodily warmth in winter, but the summers are never so hot as to make outdoor work unpleasant. Individuals and races seem to develop somewhat more slowly than in tropical climes, but their maturity is more permanent when it is attained. Most of the great industrial countries of the world—Britain, France, Germany, Belgium and Czechoslovakia—are situated in this region. Over the greater part of Europe, the natural vegetation—the forest—has been cut down to make room for agricultural, pastoral and industrial development. All the important cereals—wheat, barley, oats and rye—flourish, at any rate in the drier parts, with maize in the warmer parts. The natural fruit includ apples, pears and a number of others. In the drier regions sheep flourish on the hill pastures ; in the wetter areas the grass grows richly and afford lent pasture for cattle. The corresponding area in North America is lly suited for development, except that much of British Columbia is nountainous for settlement; and in the deep valleys which separate nountain ranges, the rainfall is often extremely low, some parts get- no more than about 5 inches a year. The mild winters of such places as ouver form a pleasant and interesting contrast to the very severe ers of the prairies of the heart of Canada. New Zealand—sometimes d the Brighter Britain of the South—forms an interesting example of ern development in the Southern Hemisphere of this type of climate. Chile's area, with too great a rainfall and too great an extent of ntainous country, remains undeveloped.

The Temperate Continental Climate

we pass inland from the regions having the last type of climate, we to great tracts in the heart of the land mass of North America and e land mass of Eurasia which are far removed from the moderating ence of the sea. There are no cooling sea breezes to counteract the me heat of summer, nor are there warm ocean currents and pleasant erly winds to mitigate the extreme cold of winter. When the land nes heated up in the spring, low pressure areas form and winds blow the ocean sufficiently moist to bring a moderate rainfall. This rainfall s mainly in the spring and summer, and affords conditions far more ble for grass than for trees. So in these regions are found the great perate grasslands of the world—the Prairies of North America, the oes of southern Europe and southern Siberia. The winters are very and very severe, the summer short but hot. Average temperatures v 0° F. are common in the winter, but the three hottest months ly have temperatures over 60° and frequently over 70°. In the nern Hemisphere, the land masses are so much narrower that the me continental type does not occur. In South America, however, the oas, cut off by the high Andes from the westerly winds of the south ic, enjoy a comparable though much more moderate climate. In n Africa Temperate grassland is found on the surface of the lofty n African Plateau. Here temperatures are much higher, snow being ity, and the existence of the grasslands is due largely to elevation. Murray-Darling Basin in Australia has also a modified continental te.

some ways the Temperate grasslands form a type of region as dis- ve in its own way as the Equatorial forests. The grass is usually and less coarse than in the Tropical grasslands, but the feature n strikes the eye is the absolute treelessness of the rolling plains. The ast, too, between the tender green of the spring, the brown, dried-up s of late summer, and the boundless sheet of snow in winter is cteristic of these regions of the Northern Hemisphere. The animals, the Tropical grasslands, are divided into the grass-eaters, swift of o escape from their enemies, and the carnivores, amongst which must really be classed.

mitive man, as a native of the grasslands, is indeed primarily a r, as were the Red Indians of the Prairies. The second stage in human development comes with the domestication of such animals as the sheep, the goat, the ox and the horse. Pastoral industries become of prime importance, and man is nomadic, wandering about with his flocks and herds in search of fresh pastures. Droughts and a consequent shortage of pasture have repeatedly led, throughout history, to great movements of these nomadic peoples and raids on the settled populations of surrounding lands. It is interesting to note that in the grasslands of the Southern Hemisphere, the rearing of sheep is still the first industry, as in Australia, South Africa and parts of the Argentine. In Canada and Russia the extremes of winter cold are too severe for sheep-rearing to be really successful ; but a climate so favourable to the growth of native grasses has naturally proved favourable to those grasses which man has helped to perfect as the main cereals. The Temperate grasslands have become the world's granaries, from which the deficiencies of the industrial countries are made up. Except in South Africa, where maize is the leading cereal, wheat is the crop of first importance in international commerce, followed by barley, oats and rye. The Prairies, the Pampas, the Veld of South Africa, and the Downland of Australia are already well tilled ; but there are still areas to be developed in Asiatic Russia. One large area of rather dry grassland remains undeveloped in Mongolia and Manchuria, where Chinese settlement is penetrating gradually along the fringes.

In the grasslands of the Southern Hemisphere, particularly in the Argentine and Uruguay, cattle-rearing is important ; but there is a distinct tendency for " bread " to oust " meat " in the competition for these lands. There are no longer the numerous huge ranches that formerly existed ; they are being broken up, and wheat farming becomes of greater importance. Hence the need for finding new lands for meat production, and reference has already been made to the importance of the Tropical grasslands in this particular respect.

The Cool Temperate Climate of the East Coasts

Whereas the Cool Temperate Oceanic Climate occurs on the western margins of the northern continents, being under the beneficial influence of the westerly winds, the east coasts are not climatically so fortunate. The moderating influence of the ocean prevents them from suffering the extremes of heat and cold experienced in the interiors of the continents, but the eastern margins of the great land masses are far colder in the winter than the corresponding western margins. Many of the ports, *e.g.* Montreal and Vladivostok, are ice-bound, though the summers are hotter than in corresponding latitudes on the west coasts. In the north-eastern United States, the Maritime Provinces and the St. Lawrence Valley of Canada, there is a well-distributed rainfall which permits of dairy and arable farming. The corresponding region in Asia, in Manchuria and Amuria, one is still in a region where the monsoon winds play their part ; so it is the summers which are hot and moist, the winters extremely cold and almost rainless. The land masses of the Southern Hemisphere are not sufficiently broad for this type of climate to be developed.

The forests which normally clothe the two regions of the Northern Hemisphere are of mixed deciduous and coniferous species. Like the

Temperate Regions of western Europe, these two tracts form “ Re-
s of Effort,” where man is rewarded in proportion to the effort ex-
led. No one needs to be reminded of the industrial development of
e portions of the United States which fall in this tract, nor indeed of
corresponding parts of Canada. The American tract has been so far
loped that it is no longer self-supporting in the matter of foodstuffs.
same development has not yet taken place in the Asiatic regions ;
ed, Manchuria is a tract as yet considerably undeveloped. It is ob-
s that if such a wonderful result may be attained with this type of
ate in America, there are vast possibilities in the future for Man-
ia. This country is bordered in the south by over-populated China,
h needs an outlet for its people. Its neighbour on the seaward side is
apanese Empire, almost equally over-populated, industrialised, and
nding on foreign supplies for foodstuffs and raw materials. Obviously
nations must have a deep interest in the development of Man-
ia ; but it is the Pacific outlet for the great territory of Russia. Hence
e nations, China, Japan and Russia, have a vital interest in the same
of the Far East. As the position is at present, Manchuria is very
ly being colonised and settled by Chinese, but the development is
e possible by Japanese capital, especially by that wonderful organisa-
the South Manchuria Railway, rivalling in the breadth of its interests
its functions the Canadian Pacific.

The Temperate Desert Climate

though occurring for the most part nearer the equator than the three
s just discussed, the Temperate Desert Climate has been left for con-
ation until now because it is closely related to four of the preceding
s. The Temperate Deserts cover enormous areas in the heart of the
mass of Eurasia and considerable tracts in the heart of North America
st in South America they are represented by the Patagonian Desert.
he Northern Hemisphere they occupy plateaux, cut off from the
ns by distance and mountain barriers. They agree in having wide
es of temperature and a very low rainfall. Generally they form huge
s of high pressure—great masses of cold air—in winter, and areas of
pressure with inblowing winds in summer. The scanty rainfall is
efore mainly in summer, except in those regions, such as Persia,
h border the Mediterranean countries.

is not necessary for our purpose to enlarge upon the characters and
different sub-types of the Temperate Deserts—the Iran type on the
r plateaux of Asia, the Tibet type occurring on the highest plateau in
world, and others. From the point of view of vegetation, there is
lly a close affinity with neighbouring, more fertile regions. Thus some
e Temperate Deserts are very, very poor grasslands and pass out-
s into normal grassy steppes. Others represent the driest tracts of
iterranean lands, and so on. Like the Hot Deserts, they are “ Regions
sting Difficulty,” where effort can scarcely count upon a sure re-
; and they remain, except where minerals have been the source of
ction, but thinly populated.

The Cold Temperate Climate

Stretching right across the Northern Hemisphere as a broad belt, is a region whose average temperature is low and where the greater part of the somewhat scanty precipitation is in the form of snow. The natural vegetation is everywhere of the evergreen, coniferous forest type. The really distinguishing feature is the shortness of the summer—insufficiently long for the effective ripening of cereals. Certainly a little oats and barley are grown, but we are here beyond the economic limit for the cultivation of wheat. In most typical stations only one month rises above 60°, and in many cases the annual average is below 40°. In certain parts near the ocean the range of temperature between summer and winter may be comparatively small, but in the heart of northern Asia there is actually a range of over 100° F.—the greatest in the world. A similar type of climate occurs on mountain ranges throughout Europe and North America. In the Southern Hemisphere only the extreme south of South America and the mountains of New Zealand have a climate sufficiently cold to belong to this type. Where agriculture is so little favoured, natural vegetation remains important. The majority of the trees are evergreen and coniferous. The peculiar structure of the thick-skinned resinous leaves affords adequate protection both against cold and excessive loss of moisture. The finest tree growth is in the warmer southern parts ; northwards the trees become scattered and smaller, or grow but slowly. Thus it takes 50 or 60 years for timber forests to regenerate in the southern margins, but up to 200 years in the northern tracts. The Coniferous Forests, or the Taïga, are the world's great storehouse of soft timber, such as pine, fir and deal. The great belt of forest stretching across North America is the most important in the world ; in Europe there are the forests of Scandinavia and northern Russia, whilst the same type reappears on the hills and mountains of north-western and central Europe. Across the north of Asia, that is in Siberia, the forested areas are largely inaccessible and suffer from the peculiar physical conditions of the land. The great rivers there flow northwards towards the frozen Arctic Ocean, and are themselves frozen throughout the winter. In the spring the upper courses in the warm south melt, whilst the central and lower courses are still ice-bound, with the result that flood-waters spread far and wide over the flat country and turn the Taïga into a vast forested morass. This state of affairs is reflected in the poor condition of much of the timber.

The sparsely inhabited and less accessible regions of the Coniferous Forests are occupied mainly, before development, by hunters and trappers, for the animals of the northern forests are protected from the cold by thick fur. The main fur-producing tracts are round Hudson Bay in Canada, and in the forest regions of Siberia. In the economy of a civilised world logging and timber-working industries take first place in these tracts, the production of wood pulp for paper being not the least important of the uses of coniferous wood. The trees are felled during the winter, dragged over the slippery snow to the watercourses, and floated down the rivers when the snows melt. Accessibility, the presence of streams suitable for floating, and the existence of water-power for sawmills and pulping mills are the factors influencing development. By far most important areas are along the southern fringes of the forest in ern Canada, and in the countries of Northern Europe. The influence ıe abundance of easily worked wood is seen in the dwellings in the sted regions, from the rough log cabins of the Canadian backwoods-, the timber-workers of Finland and northern Russia, to the elaborate den chalets of the Swiss mountain forests.

he softwood forests of the smaller countries of Europe have been ked so long that it is difficult to maintain an output of timber and wood , and certainly almost impossible to increase that output. The only countries in the world which still have very large reserves of soft oer are Canada and Russia—a very interesting state of affairs.

The Tundra or Cold Desert Climate

ithin the Arctic Circle the winters are very long and very cold— e are at least some days on which the sun never appears—whilst the mers are very short though warm. Though for certain periods the never sets, it never rises far above the horizon. It is too cold for forest; natural vegetation is moss and lichen, with stunted bushes, and small near the forest limit. Agriculture is practically impossible, for the nd is frozen for three-quarters of the year. The short, hot summer , however, sometimes, produce an amazingly prolific growth of grass herbs, which can take advantage of the continuous sunshine of mid-mer; hence the introduction of the name " Arctic Prairies," sub-ted in Canada for the old term " Barren Lands," which scarcely does ce to the region.

hough they are at present almost uninhabited, there seem to be future ibilities for the development of these lands, by the breeding of rein- or caribou, the natural animal inhabitants, whose flesh and skins a very definite economic value. Northwards the Tundra lands pass regions of permanent ice and snow, the plateau of Greenland repre-ing the ultimate development of the extreme type of Cold Desert ate. To this the Antarctic continent corresponds in the Southern isphere.

efore terminating this section, it is necessary to emphasise again the ence of transitional belts between the various types of climate which just been described. It is necessary also to emphasise the existence of variations in each of the major climatic regions—local variations h are due, in particular, to differences in elevation. In a very broad we may be said to pass through the same vegetation zones in ascend-mountain in the Tropics as we do in journeying from the Tropics wards. The mountain softwood forests of the Himalayas, or of the , or the Carpathians, are the counterpart of the great Coniferous sts of northern Asia or northern Europe; whilst above come the pine " pastures, which are the counterpart of the Arctic pastures just ribed. The variety in the natural vegetation, and so in natural re-ces, afforded by these vertical zones, in a mountainous country such witzerland, is a matter of obvious importance.

IV. WORLD GEOGRAPHY AND INTERNATIONAL RELATIONS

There are many dramatic critics who hold that Shakespeare should always be played without the distraction afforded by scenery or period dress. Carried to its logical conclusion, the best way of appreciating the rhythm of the words, and the beauty or intensity of the thoughts they clothe, would be in the quiet of a darkened room with merely a loud speaker to convey the spoken word. Yet who has not listened to the broadcast of some everyday comedy, and wondered all the time what could possibly provoke the obviously spontaneous peals of merriment from the audience in the theatre itself? We are all compelled to follow the world's events in precisely this way—robbed of the stage and setting. It is little wonder that the events often appear to have an intangible sequence and no discernible cause. But as voting citizens we have a very real share in the control of those events of which we really know so little and understand less. Surely it is a first duty at least to attempt a better understanding of those events by an appreciation of the *milieu* of their occurrence. It is not without reason that a recent writer called a series of his school textbooks the "Citizen of the World Geographies." For we have attempted to show that the first aim of Modern Geography is an interpretation of the stage on which the play of history, past present and future, is set.

It is only possible here to indicate one or two aspects of the rôle played by geography in international relationships.

There is, in the first place, the economic aspect. Our modern civilisation demands products from each of the major climatic regions, and international trade is almost essentially an exchange between regions of diverse geographical character. Yet only one political unit includes within its own bounds portions of each of these regions. That unit is the British Empire. From this point of view the British Empire could be an economic unit, self-supporting and self-contained. It must be noted, however, that the climatic regions do not govern the mineral products and the Empire, rich in coal, must remain poor in mineral oil.

The position of some of the other great powers is interesting. Continental United States, despite her 3,000,000 square miles of territory (more than half of it in favoured climates), does not stretch into the tropics or equatorial regions, and must depend on foreign supplies of tropical and equatorial products. Thus the greatest consumer of rubber in the world, as we pointed out above, must purchase from British or Dutch sources, or develop plantations with American money on alien soil. The United States' need for tropical products has undoubtedly influenced her foreign policy in many directions. Cuba, the greatest cane-sugar exporter in the world, though nominally a republic, is in a definitely subordinate alliance with the United States, which likewise dominates the other tropical West Indian islands of Haiti and Porto Rico. Sentimental attachment to the Monroe Doctrine scarcely explains the purchase of the Danish Virgin Islands. In her main tropical possession, the Phillippine Islands, the United States can hardly be described as fortunate. So the whole of the vast quantities of coffee, as well as cocoa and tea, must be purchased from foreign nations. It is interesting to note the character of the United States trade with countries, such as Argentina and Australia, that lie in ıdes similar to those of the States themselves. Her purchases of products are limited, but her interest in the sale of manufactured s is much greater.

the interest of the United States in the neighbouring tropical islands e West Indies is evidence of a desire to control certain sources of cal products, it is small wonder that her progressive neighbour, ıda, should have an equal desire. Indeed the British West Indies are lly becoming a tropical dependency of the Dominion of Canada, and xcellent steamship services between the Dominion and the West es is evidence of the closeness of that relationship.

ırning to the vast territory of Russia, it is interesting to notice that ia is in a position somewhat comparable with that of the United States rather of the United States and Canada combined. For she shares Canada the enormous reserves of softwood timber and the products able from the northern forests. In her fertile steppe lands she shares both countries the advantages of possessing an enormous granary, as far as southern Siberia is concerned, only partly developed. But ite her 8,000,000 square miles of territory and her 150,000,000 in- ants, Russia is even more dependent upon foreign supplies for tropi- nd equatorial products. She does not include within her boundaries territory which can be described even as warm temperate; but in ian Turkestan a very large area of Russian territory may be described emperate Desert or on the fringe of the Hot Desert. When irrigated ınd is fertile, and so, in this tract at any rate, certain tropical products oe produced. Foremost amongst these is cotton, that is so urgently ired for Russia's own cotton industry. But where people depend for food supplies on irrigated crops, it is obvious that a major propor- of the land must be devoted to food crops, and only a small propor- can be given over to such non-food crops as cotton, however badly may be required in other parts of the country. Herein lies the guiding ve for the new Turk-Sib railway, constructed at great expense and great difficulty to link Turkestan with Siberia, and towards the con- on of which strenuous efforts were made in 1929 amd 1930. For ria is the granary, and can produce vast quantities of wheat and foodstuffs. By the railway these can be easily transported to Turk- , thereby releasing the land in Turkestan for the cultivation of the temperate or tropical crop, cotton, which Siberia cannot produce.

is aspect of international relations is closely bound up with another distribution, or perhaps one might say the maldistribution, of popu- . Considering in the first place a purely agricultural population, are certain of the major climatic regions which can support a large lation, others which can only support a very limited population. t is maldistribution of population within any given climatic region h is even more serious; for there is a very strong tendency for im- ınts from any particular clime to desire to settle in a country whose te is similar to that of their own homeland. Other things being equal, will probably be more successful given such familiar conditions. the Indian peasant farmer would be attracted primarily by other ns with a monsoon climate similar to that of his own home, and dly by such areas as the tropical lands of Africa, or the warm temperate lands where climatic conditions are roughly similar and where he can carry on agriculture in the way to which he has been used at home. Unfortunately it is often a matter of the utmost difficulty to persuade a cultivator to try his fortunes under climatic conditions with which he has no experience. Despite the congestion on the cultivable land of Japan, it has proved difficult to dispose the Japanese farmer to colonise the northernmost island of the group, simply because of the extremely cold winters, to which he is unaccustomed and which he cordially dislikes. Similarly, this has undoubtedly been the chief deterrent in keeping the Japanese farmer from developing the wide, open grasslands of Manchuria, where conditions are comparable to those on the Canadian prairies. Japan is willing to supply the money, but the cultivation has been done by the Chinese, already used, in the north of their country, to the climate of cold winters. The degree to which these general principles will apply is sometimes amazing. It has been said, with very considerable justification, that the Polish settlers in Canada, used as they are to the poor soils of the eastern portion of the north European plain, are more successful on the poorer lands of Canada than they are on some of the richer tracts. Perhaps one might almost venture to say here that the Italian labourer, coming from the sunny climes of Italy, is the most successful of the European peoples in the sugar plantations of Queensland, under conditions which the north European finds unpleasantly warm. Great value attaches to the attempts to discover what are the limiting climatic conditions under which outdoor labour is possible for white men ; whether, for example, the highlands of East Africa are possible for permanent white settlement or not; whether northern Australia can or cannot be developed by white labour. But the personal factor undoubtedly comes in. Even if it is possible on health grounds, all depends on whether the white man has the desire to work under such conditions. It is useless, therefore, to take a population map of the world and calculate which are the areas that require a larger population and should be developed, unless we consider the climatic conditions from the point of view of the major climatic regions. If this is done, we get some very interesting pointers as to the land which remains to be developed and the lands which are likely to attract most attention in the near future from this point of view. As an example, we may take the tropical monsoon region, which we have already noted as including India, Indo-China and south China. India and China are already densely populated—it might be said that they are saturated ; but between the two lies the under-saturated territory of Indo-China. Peaceful invasion by agricultural settlers is going on from both sides ; the Indians settle in British Indo-China or Burma, where they meet an attenuated stream of Chinese, not in this case bent on settlement of the land. On the other side of the mountain divide between Burma and Siam we find that the stream is a stream of Chinese, and that Indians are distinctly in the minority. The meeting-place of the two streams of immigration is in the peninsula of Malaya. A few years ago one could point to the excellent balance in the population of Malaya—about one-third native Malays, one-third Indians, largely composed of coolies working on the plantations, and one-third Chinese. The state of political conditions in China has doubled or trebled the strength of the Chinese immigration, so that there is a ominance of Chinese immigrants. These undeveloped monsoon terri- are not large, and we turn to other countries which are under- lated, and everything points indisputably towards northern Austra- 'he attraction for Indians of the similar climate of the east coast of a has already produced serious problems, regarding the political of these immigrants, which are amongst the foremost problems of ritish Empire. The population problem in Japan has almost reached is. If it is regarded merely as a problem of supporting a given popu- on a given area, then Japan has reached saturation point. Of her gn possessions, Korea already has a large population of its own, and, a mountainous country, cannot very well support a much larger ɔer. The possibilities of settlement in Formosa, another possession pan, are limited, and the possibility of Japanese penetration into churia, following the penetration of Japanese capital, is definitely ered by the attitude of the Japanese farmers. America is practically l to Japan, the whole of Australia is closed, and her people are now ning across the Pacific to the lands of South America. We are struck e fact that this does not seem a very satisfactory solution of the em. There is, of course, another alternative for Japan—namely, asing industrialisation and organisation. The War, when supplies not easily available from Lancashire, gave a great opportunity to apanese cotton industry to gain the cotton markets of the whole of ar East, which she actually did to a very large extent. But the main- ce and definite increase of supply to those markets, so as to support er larger industrial population at home, is no easy matter. Even if hould be accomplished, Japan is faced with the problem of raw rial. Her deficiency in coal and iron makes a hold upon Manchuria Manchuria's reserve of these two commodities essential. With very derable justification, Japan is loth to rely upon the doubtful quantity r friendship with China for the maintenance of these supplies, and or the maintenance of supplies of raw cotton. To cut off the Man- an supplies of coal and iron, or the Chinese raw cotton, would be to f the life-blood of a progressive and virile nation, with consequences may well be imagined.

t perhaps the most interesting problem of this character is to be l in Europe, in the contrast between France and Italy. Both had a ation, at the census in 1921, of approximately 39 million; but the of France is 213,000 square miles, the Italian area only 150,000 e miles. With her fertile soil, her share in two of the major climatic ns of the world (both of them with their own characteristic crops), ery considerable reserves of coal and her very large reserves of iron rance is placed in a favourable position, more especially as she has a , or even declining, population; and it is small wonder that France present time is the country *par excellence* in Europe with no un- oyment problem. Italy, on the other hand, is a smaller territory, has al, little iron and a country much of which is too dry or too moun- s for cultivation. Her population, in 50 years and despite enormous ation, has increased by 50 per cent. If we turn to the overseas pos- ns of the two countries, we find France with a vast overseas dom- No one who has been recently to Morocco or Algeria will deny the ability of the French to organise or develop those territories abroad over which she has control. Her dominions give France, too, an almost complete independence in the matter of the supply of principal raw materials. On the other hand, France, with her comparatively small population at home, which can be supported on her European territory, has little or no need for any outlet for her people. Her foreign territories are not really required for the settlement of her own surplus agricultural population. What a contrast is afforded by Italy ! She is a steam engine without a safety valve. It is true that figures show Italy with foreign possessions of something like 800,000 square miles ; but this total is made up of the huge tract of Libya, in the main a large portion of the Sahara Desert in north Africa, over practically the whole of which settlement is impossible. The colony of Italian Somaliland is but little better, and supports at the present time a population of little over a thousand Italians. Similarly with the colony of Eritrea on the Red Sea. So that the Italian colonial empire can be dismissed from the point of view of settlement.

Is not the disparity between France and Italy, in their respective share of the fertile climatic regions of the world, the real cause of the French-Italian naval disagreement and the insistence by Italy on naval parity with France ? Yet until the problem is considered in its geographical aspect, the sympathies of the man in the street are more likely to be with France in this particular connection, because it is Italy which seeks to establish parity, France which seeks to maintain the superior position she held in the past.

Perhaps sufficient has been said in these few examples to establish the claim of geography to serious consideration by those who are concerned with the study of international problems.

An extraordinarily interesting subject of study is the geographical character of international boundaries. Broadly speaking, the most satisfactory frontiers are those which are not only political but geographical. Just as a great range of mountains usually acts as a water-parting, sending the rain which falls on the one side towards one ocean and the rain which falls on the other toward another ocean, so does it act as a human parting. The thoughts of the people tend to flow, like the water, away from the mountains towards the lowlands to which they look. We have already referred to the importance of this aspect, and, moreover, except sometimes for mineral or water rights, a mountainous area tends to be economically unimportant and disputes relative to a frontier running through such a tract are therefore less likely. It would be difficult to deny the satisfactory character of the Pyrenees as a frontier between France and Spain, while the Andine chain is the natural frontier between Chile and the Argentine. The most satisfactory and perhaps the most stable of the new countries of Europe, namely Czechoslovakia, has a well-defined mountain frontier as far as the boundaries of the plateau of Bohemia are concerned. The satisfactory use of the sea as a frontier need scarcely be referred to, but special interest attaches to the use of rivers. They have the advantage of being clearly defined ; but their influence may work in more than one way. Wherever nations are in ready communication with one another and have common interests in the use of the river as a highway of trade, they tend to be linked economically and to develop a munity of outlook and a community of interest, which naturally work ırds international friendship. On the other hand, where the use of river is required particularly for irrigation, for power, for fishing ts, or for the establishment of ports, the very existence of the river dividing-line between two nations may very easily cause friction. ecially is this the case if the mouth of the river is in alien territory ı those of the nations who share its banks. An interesting example of t may happen is afforded by the protracted arguments as to the use he waters of the Murray River between the Australian states of oria, New South Wales and South Australia. Victoria and New th Wales both require its water for irrigation purposes; but it hes the sea through South Australian territory, and it is obvious that oportion of the water must be reserved for South Australia's use. Rhine, as a source of power in Switzerland and an outlet of that ıtry, as a frontier between Germany and France with its outlet to sea through Holland, immediately suggests complications. Or again, Danube, rising in Germany, passing through Austria, forming the tier of Austria and Czechoslovakia, passing through the heart of gary and through the heart of Yugoslavia before it flows into mania and thence to the sea, is another example of a great river se use as a frontier is not always satisfactory. The problem has me so severe that it is only an international Commission for taking the river rights, and the formation of a definitely international river, ch can solve it.

n the whole it may be urged that a river is an unsatisfactory frontier, a purely artificial boundary, a straight line drawn on a map, is lly still more unsatisfactory. It is true that its character may depend he type of country through which it passes; for example, if the line es through a desert country, then it is probably the most satisfactory ı of boundary. But the varied fortunes of such a nation as Poland ıe last two or three hundred years afford evidence of the fate of ly artificial frontiers, which have no strong geographical background. another aspect of the use of geography in the study of international lems is in connection with transport and communications. The y of a political map will often reveal communications, particularly communications, by land which are desirable for the better linking f nations. But the study of a physical map shows immediately the ical barriers which will prove permanent obstacles to such development. We shall refer below to the use of various types of economic maps, we may note here the importance of such maps in demonstrating e regions which do definitely require improvements in transport, here the improvement of communications is a matter of prime rtance.

V. GEOGRAPHY AND NATIONALITY

far we have been concerned mainly with the geography of the d as a whole, that branch of the subject which is often referred to adays as "world geography." But although these broad international ionships and their geographical study are matters of supreme rtance, there is equal need for the detailed study of definite regions.

Few can hope to attain a really useful grasp of the geography of all the countries of the world but, armed with a general background of the type which we have attempted to delineate, the geographer is well equipped for the detailed study of a definite area or a definite country. Indeed, for the progress of modern geography it is imperative that it become parochial, and that the geographer should devote himself to a definite country. This brings us to what is generally called " regional geography," because it deals with definite regions.[1]

Whether one undertakes the study of a broad region, such as the " Far East," or a single political unit, it is essential to follow a definite logical order. One should first consider aspects which concern its position on the globe, its distance or nearness from the great land masses, and so on. Then take in order its physical features, its geological structure, its climate, its natural vegetation and its animal life, exactly as has already been done in studying the world. At this stage we come to a very important conception—that of the natural region. We have learnt how useful is the conception of the world divided into major natural regions on the basis of climate; but when we come to the study of a single country, we find that this can likewise be divided into small units or natural regions on the basis of community of geographical factors. It is true that we may select almost any one of the great geographical factors for this purpose. Thus, we may consider a country as divided into physical units and structural units according to its topography and its structure respectively; or we may consider its smaller deviations in climate and divide it into climatic regions. Regions based on natural vegetation and agriculture, which generally go together, often bear a very close relationship to the regions which are distinguished on a climatic basis. Usually, however, a country is most satisfactorily divided into natural regions by a consideration of all these factors. Throughout any one natural region we may expect to find a certain similarity of topographical features, and a similarity of geological structure, of climate, of vegetation and of animal life, including the life of man, which is also largely moulded by the factors. It comes as no surprise to the geographer to find that his natural regions so defined bear an extraordinarily close relationship to what may be distinguished by the sociologists as " cultural " regions. Some years ago the writer attempted a division of India into natural regions on a geographical basis; almost simultaneously the division into cultural regions was undertaken by Mr. F. J. Richards. The results of these two studies were practically identical in all cases. Indeed a geographical natural region is often the race-home of an individual type. The group consciousness, which we call nationality, tends to develop within such a natural area, so that a natural geographical region is not infrequently an area inhabited by a single racial type with a common cultural and economic inheritance. Thus the most stable political units are undoubtedly the ones which correspond most closely eographical regions or units, and it should be noted that the geo-her's natural regions are not limited to considerations of physical economic geography alone, since the natural factors are reflected ulture and language as well as in national consciousness. The plain ungary is a geographical region. It is occupied by the modern state ungary and by the nation known as the Hungarians. This forms at a contrast with the Bohemian plateau and its inhabitants, the hs. Geographically the limits between the two natural regions are well defined; the spurs of the Carpathians project on to the Hun-n plain and many of the Hungarian plain-dwellers live in close imity to their Slovak neighbours of the mountains. So just as the raphical line of division between the highlands of Czechoslovakia ates them with difficulty from the lowlands of Hungary, so the national frontier between the two countries is extremely difficult to up satisfactorily.

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[1] Space does not permit of enlargement upon other aspects of specialisation in the study of geography; but a very profitable line of study embraces the conditions influencing the production of, and trade in, any particular commodity, as well as the geographical conditions which affect the development of trade in any one particular region.

ost political units, however, include more than one natural region. od example is afforded by Scotland, which falls very clearly and ously into at least three divisions : the Highlands, the Central Low- and the Southern Uplands, distinct geographically and in nearly her respects. The study of natural regions may be carried further, smaller and smaller units may be distinguished; and it is this that rlies the tendency of modern geography to a development of what own as regional survey. It is only by an accurate and detailed survey aspects of the geography of a country that we can delineate wherein ifferences between individual parts. In the county of Kent, for ple, there is obvious contrast between the fertile, market-gardening of north Kent, the pasture lands of the Downs and the hop-garden ns of the Weald.

is often difficult to express in words the exact character of these ences between different parts of a single country. In this the geo-her relies more and more on what has been described as his principal for the map, according to Sir Halford Mackinder, is the tool of the apher. In this regard geography, that is social and economic aphy, can well perform the function of the handmaid to the science onomics. To give a single example of what is meant here; a student e economic development of India would of necessity be concerned the production and export of foodstuffs, and would be concerned the three principal foodstuffs of rice, wheat and millet. Statistics how the relative areas which these three crops occupy in India; ay go further and use statistics to show the relative areas which occupy in the separate provinces of India. But the geographer is rned with even more exact relationships than these; and he would ally construct a map of India, showing by cartographical methods y where are situated the tracts under the three different crops. common method used for this is that known as the dot method, ing one dot on the map to represent so many acres or so many tons duction of a certain crop. The dots are placed as near as possible the actual production takes place. The result is seen in the three given here, which show the areas of production in India of rice, and wheat. Such maps often suggest the factors which are in the main responsible for the particular distribution. In the case of India, rainfall is the factor of paramount importance, and so on the maps illustrating this section certain rainfall lines have been inserted to show the connection. High land is also shown to demonstrate the effect of altitude on the distribution of main food crops. The deductions to be drawn from such maps are briefly indicated in the underlines.

We may go further with such maps, and use them to demonstrate the actual areas within which expansion or development is possible or likely.

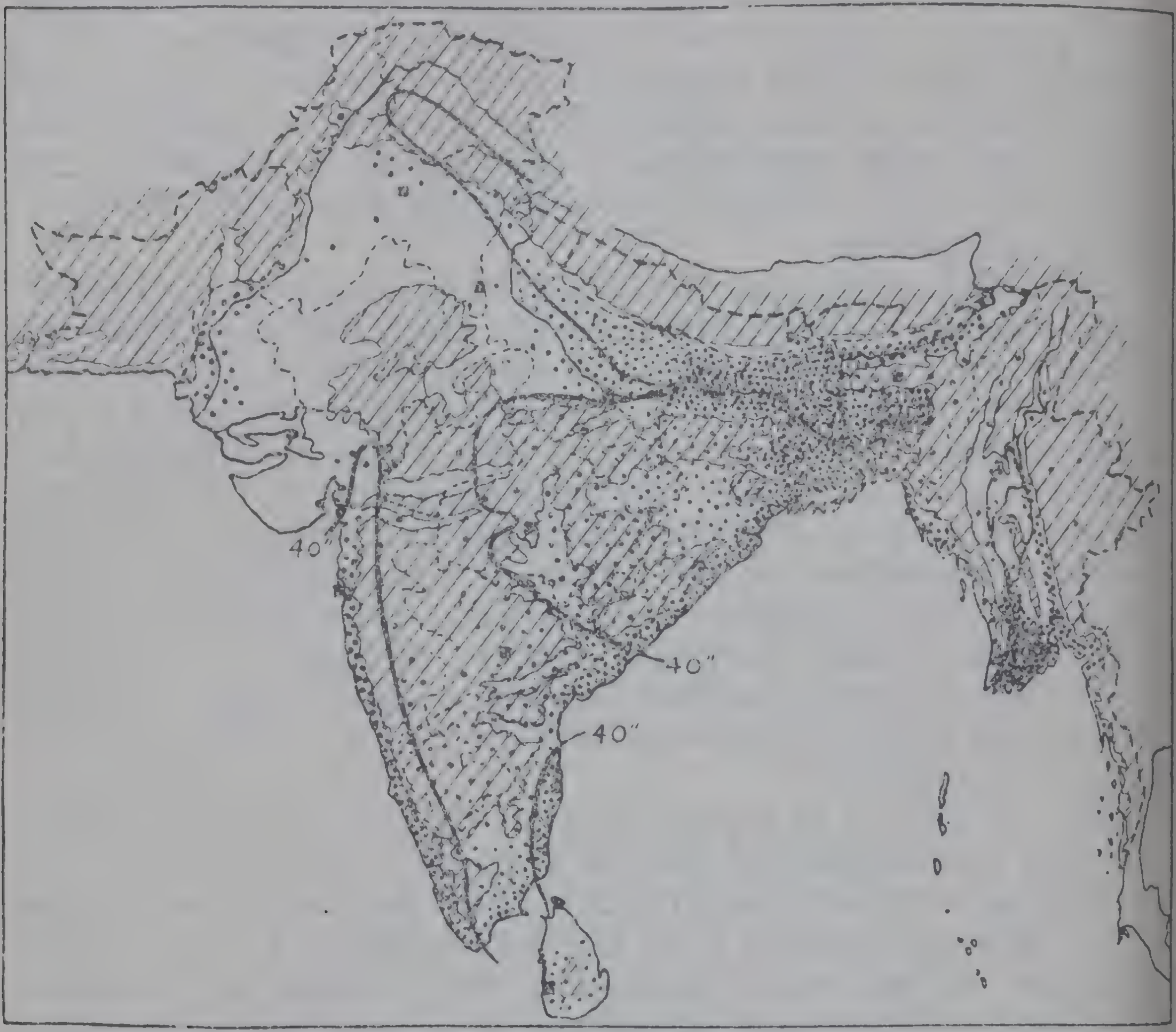

Fig. 2. Map showing the distribution of rice in India. Each dot represents 50,000 acres sown. The squares show for purposes of reference the positions of the capital towns of each province. The lined area shows that part of the country which is more than 1,000 feet above sea-level, and indicates the greater importance of rice in lowland areas where there are flat fields which can be flooded. The lines shown are the 40-inch annual isohyets or rainfall lines, and demonstrate that rice becomes unimportant where the rainfall drops below 40 inches.

Another important branch of geographical investigation concerns itself with the factors which determine, or have determined, the position of human settlements. In this regard the geographical factors were undoubtedly much more in evidence amongst primitive men, as determining, in the days of old, the initial position to be chosen for settlement; and very often the geographical factors have become obscured as time has advanced. For instance, we may take the case of London. In a part of the country far removed from coalfields or any other source of power, nat half of the country which is agricultural rather than manufac- ıg, London is some distance from the sea and it does not offer any special advantages to shipping ; and it is at first difficult to see why ould remain the premier city of the world and the premier port of and. For an explanation of the advantages of London's position, ıave to go back to the geographical factors which operated in the early days of settlement. In those days the lowest point on a river h could be forded or bridged assumed a special significance, and

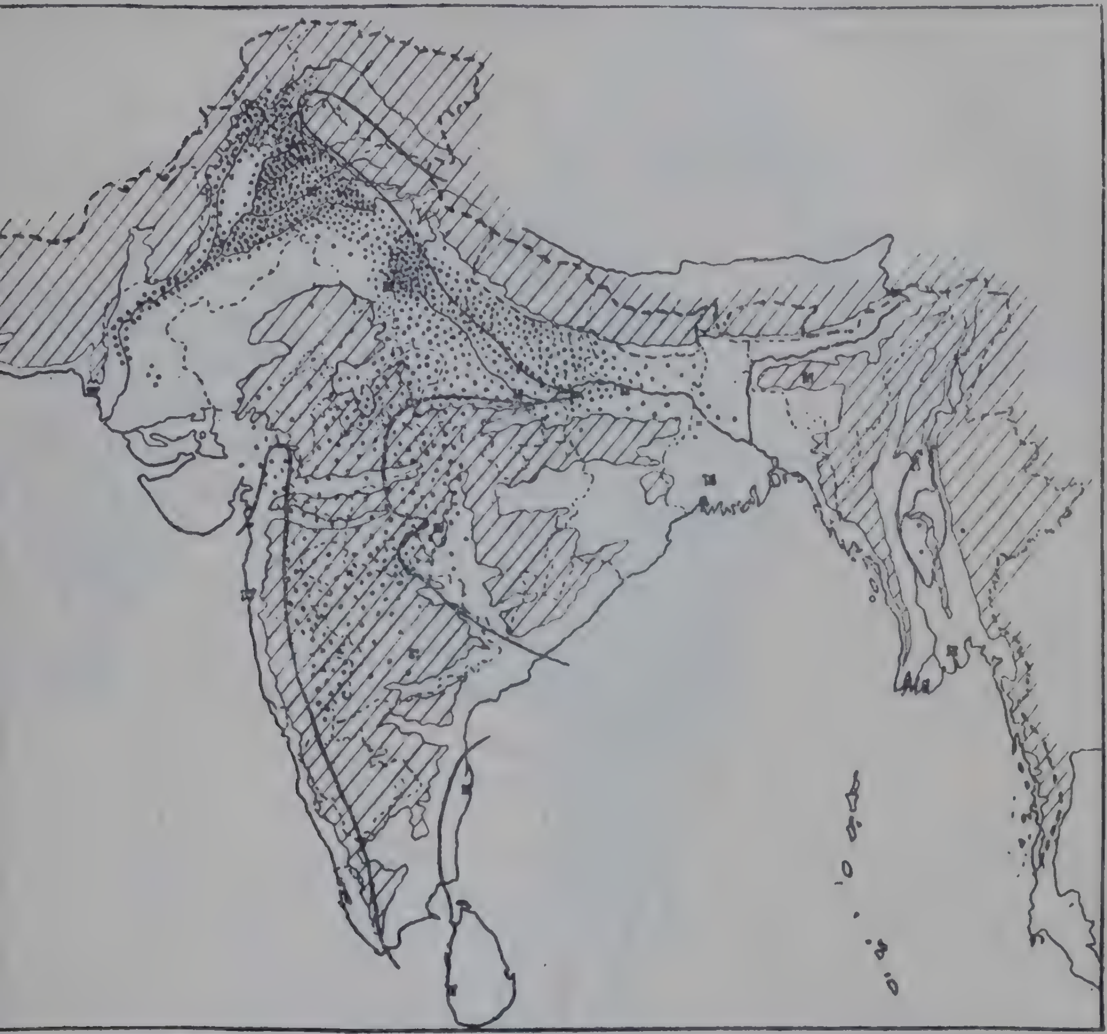

Fig. 3. Distribution of wheat in India, showing the concentration in he Punjab and the United Provinces. There is still a tendency for the rop to be concentrated on the lowland areas of rich alluvial soil. Nearly ll the wheat-growing areas have less than 40 inches of rainfall a year, ut it should be noted that the crop is important mainly in those parts f northern India which have a marked cool season. Each dot represents o,000 acres. The lined area is more than 1,000 feet above sea-level.

on Bridge may be said to occupy roughly this position. It is interest- notice that it has held the position of the lowest bridge over the nes for more than 2,000 years, if we except the Tower Bridge with mewhat special method of construction. The river ford or bridging must be capable of being defended against attack, so the presence he river of high ground, which could be surrounded by a wall or ade and which was not liable to be flooded, was an attraction. It icult perhaps to imagine the day when London was concentrated on a hill, or group of hills, of which the crest of one is now crowned by

St. Paul's Cathedral, and which sloped down by Ludgate Hill to the valley of the river Fleet. Away to the north of the city were again marshy tracts and fields, the presence of which is indicated to-day in the name of Moorgate. This hill, easily defended, surrounded on all sides by marshes or by rivers, was an ideal site for a town which should guard the lowest fording-place on the river Thames. For long these considerations determined the direction in which London should spread out from its original centre. The drier sandy ridges were settled, while the damper clay valleys between them were still neglected. But these factors have so been obscured, that we must go far back in history to trace their once enormous importance. It is much the same with the other great cities of the world. It is possible to find, if we go back in their history, very potent geographical factors that influenced their growth. We may take the example of New York, at the entrance to the one significant gateway across the difficult country of the Appalachian mountains *via* the Hudson

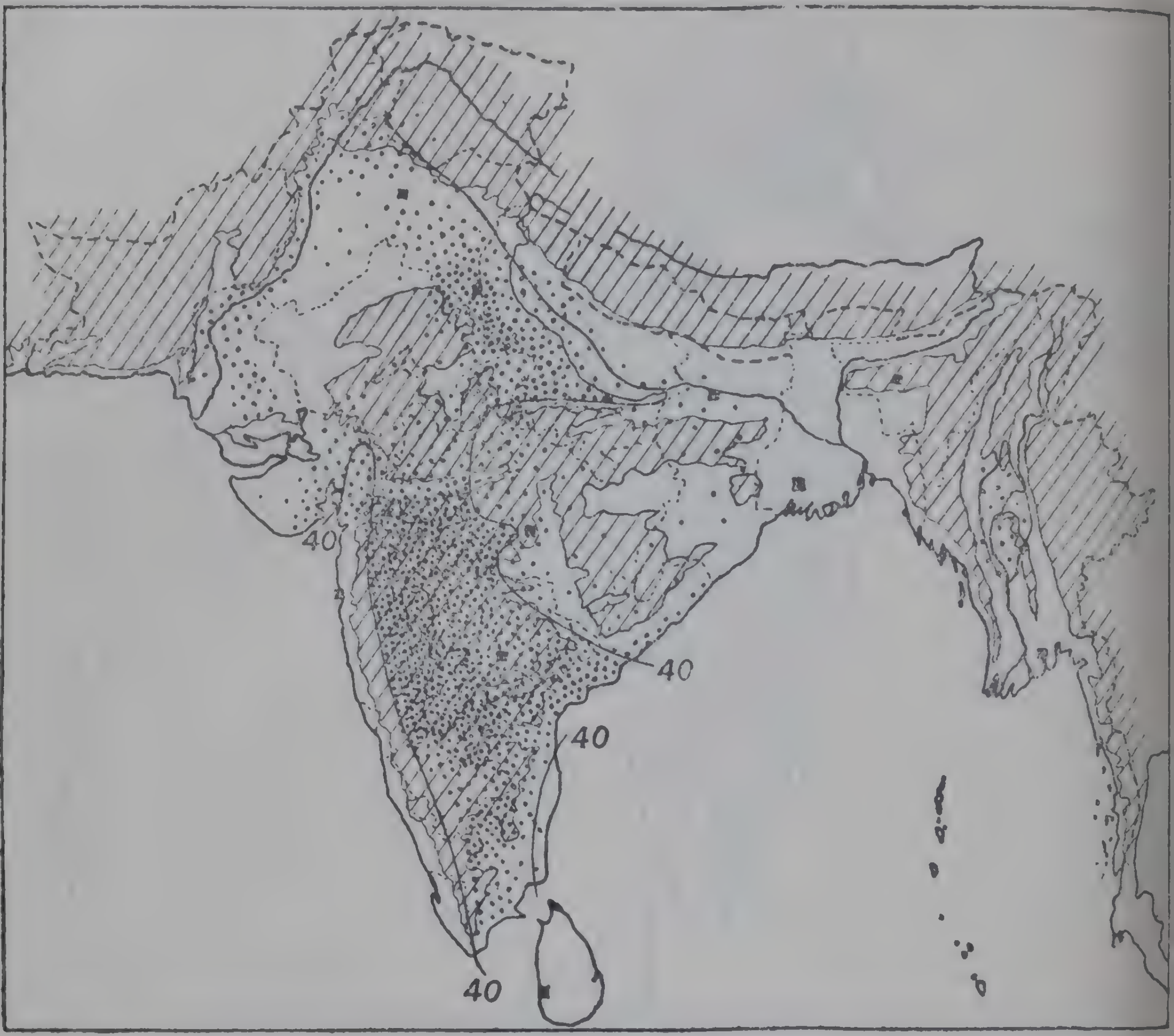

Fig. 4. Map showing the distribution of millet in India. Each dot represents 50,000 acres. The lined area is that part more than 1,000 feet above sea-level. The lines shown are the 40-inch isohyets and demonstrate that millet is essentially a dry zone crop, but that it can be grown on the hilly or poorer regions, whereas the better soil of the alluvial plains is utilised for wheat.

[The three maps, Figs. 2, 3 and 4, show how very different are the chief crops and consequent agricultural practice in different parts of India, and how climate is essentially the controlling factor.]

he Mohawk gaps. Or there is the position of St. Louis. In the early of American expansion, the great rivers, the Missouri, the Missis- and the Ohio, were the principal highways in the new country, an obvious nodal point for settlement would be just below the ion of the three ; the exact position of such a town would be settled e presence of suitable land, near the river but free from floods ; dal town, once started, later became a focus of railways, with the that it has risen at the present day to be one of the great focal of the United States. The origin of Birmingham, in the midlands gland, may be traced to the days when it was a small market town ed on a relatively infertile plateau but surrounded by fertile agri- ral land, which then became a common meeting-place for the ers of those surrounding tracts ; they would require, above all other s, horseshoes and simple agricultural implements. It is to their nd perhaps that Birmingham owes its great hardware industry, just rby owes its Rolls-Royce factories to the day when it was a meeting- for coaches. A special reason may be given for the interest which possess. There are nearly always two points to be considered in g the growth of a port ; in the first place, its local position ; in the d place, its position relative to the hinterland and economic region it serves. It was the now unimportant little river Hull which was nsible for the early growth of Kingston-on-Hull, now simply Hull, uses not the smaller river, but the Humber itself. Similarly, Liver- with a tiny sheltered harbour, now no longer existing, suitable for g-vessels, was the precursor of the modern great port. All these subjects of fascinating interest for the student of regional geography.

VI. CONCLUSION

dern geography has been described by an American writer as n ecology, the study of the human species in relation to its environ- . Since we cannot rightly understand the importance of human s without an adequate consideration of the stage on which they are d, it must be claimed that modern geography should occupy a key on in any modern educational system, and that a study of modern aphical ideas is a vital element in the equipment of every national nternational citizen—more especially for those who are concerned the administration of national or international affairs. The geo- er's use of maps is an amazing discipline in an accurate presentation ts. It is easy to be vague in phraseology, but difficult to be vague signs and symbols of a modern map ; or if there is vagueness, it is easy to see at a glance. Geography is, in effect, a point of view. iously or unconsciously, it is becoming the universal point of view. ld which has endured the World War of 1914–1918 and the subse- economic complications has, of necessity, grown geographically- d.

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INCIPLES OF LITERARY CRITICISM

By

LASCELLES ABERCROMBIE

SYNOPSIS

TRODUCTORY. Criticism a distinct species of literary activity — It
upposes literary creation and literary enjoyment — It cannot
ce either, but it can help both — It exists, however, in its own
; and may take two forms, according as it enquires into general
tion (theory of literature) or particular merit (criticism proper) —
se two forms overlap and are necessarily interrelated.

HE ART OF LITERATURE. In literature, experience is *expressed* in
uage — But it is also *represented* in language — The two ideas
combined if we say that, in literature, language *communicates*
rience — In literature as an art, experience is communicated for
wn sake, to be valued as such — This means that the author's
rience must be re-created in the reader — Language in literature
be a symbol of experience, communicating both its substance
ts value, and so used as to unite all its parts into a single complex
e — Diction symbolizes the substance, form symbolizes the
of the experience which inspires literary art — Poetry the type
at art.

ARISTOTLE'S *Poetics*. Permanent importance of the book — Limita-
of Aristotle's treatment — His opposition to Plato — The true
ine of " imitation " in literature — The supreme place of the
of unity in literary theory — False ideas of unity — The function
iterature exemplified in tragedy — Character and action :
tharsis."

FTER ARISTOTLE. *Horace* as disseminator of Aristotle's theory in
rm of critical principles — " Good taste " a rational conception
ante's " allegorical " theory — *Sidney*, *Bacon*, *Kant*, *Croce*
nue the direction of Aristotelian theoretical criticism —
nginus " and stylistic criticism — Its English tradition : *Ben*
n, *Pope*, *Wordsworth* — Romanticism and the sublime : *Burke*,
, *Lessing*, *Manzoni* — The English romantics.

NCLUSION. The rules of criticism : their theoretical basis —
subjective element — The freedom and responsibility of
ism.

PRINCIPLES OF LITERARY CRITICISM

I. INTRODUCTORY

When Socrates was explaining to his judges how it was that he had made himself so unpopular, he told them of his investigations into the wisdom of those whom the world reputed to be wise. The enquiry had been strangely disappointing ; and when he came to describe his encounter with the poets, " Gentlemen," he said, " I am ashamed to tell you the truth. I took the poems which seemed to be most carefully composed " —the suggestion is, that these were the poems in which the poets ought to have been most conscious of what they were doing—" and I asked them what they meant." But the poets could not tell him that : " There was scarcely a man present "—for it seems these interrogations took place in the presence of the poets' admirers—" who could not talk about these poems much better than the poets themselves."

Socrates had, in fact, made a discovery of first-rate importance. With the peculiar and characteristic turn he gave to his discovery, we are not now concerned. The thing for us to note is, that he was the first person to distinguish between the ability to criticize literature and the ability to compose it. " I soon found out," he said, " that poets do not compose poetry because they are wise, but because they have a certain nature or genius, which is capable of enthusiasm,"—or, as we might nowadays put it, of being inspired ; poets in this respect being, he went on, " like prophets and oracular persons, who also say many fine things without knowing what it is they are saying." When he invited the poets to tell him what their poems " meant," Socrates was testing them for what he called " wisdom " : that is to say, for the power of rational analysis conducted in strict accordance with definite intellectual principles. In other words, he was inviting them to criticize their own poems. He found them unable to do so.

If it had suited his purpose, Socrates might have gone on to point out that the power to enjoy poetry is also quite different from the power to analyse it rationally. The power to enjoy poetry, like the power to compose it, proceeds from a certain nature. Very probably, indeed, both powers proceed from the same nature ; only in the one case it exists passively, in the other actively. Nevertheless, the two powers themselves are obviously quite distinct. And now to these must be added a third power—the power to criticize literature. For when Socrates interrogated the poets, he was not putting impertinent or unnecessary questions. Ever since man became conscious of possessing in the art of literature a region in which he could exercise some of his most delightful and most profitable energies, people have not only been asking what poems " meant," but all sorts of other questions as well, which properly fall under the heading of criticism. What makes Socrates' " Apology " the first milestone e history of criticism is simply this : that there Socrates for the first clearly pointed out that criticism is a distinct species of literary ity, and also why it is distinct.

e may say, then, that the realm of literature is occupied by the ac- es of three distinct powers : the power to create, the power to enjoy, he power to criticize. The chief thing that distinguishes the power to ize from the other two is the fact that it can be acquired. For, though ism may be intuitive, the critic may also be conscious of the process hich he criticizes ; and this process appeals to certain intellectual iples which can be set out in an orderly system, studied, and deliber- put into practice. But there are no principles which will tell you how eate literature, nor how to enjoy it. Criticism, then, does not pretend count for the state of mind in which literature is created, nor for that hich it is enjoyed : still less does it pretend to bring these states of into existence if they do not exist already. It assumes their exist- : for the person who can neither create nor enjoy literature, all ism must be entirely meaningless. That is to say, it assumes the fact literature exists ; and it then proceeds to enquire into the nature of fact, to expound it, to assess its value, and in a word to think clearly t it.

d this, as Socrates pointed out, is quite distinct from the power to e literature, and, as he might have pointed out, quite distinct also the power to enjoy it. Nevertheless, though perfectly distinguish- it can co-exist with either of the other two powers. Socrates may been unlucky in his poets : not all the poets living in his day, one ines, would have been incapable of telling him what their poems ant." Perhaps those whom he questioned found it a little difficult to out what Socrates himself " meant " when he asked them what poems " meant " ; perhaps they thought it a sufficient answer to hat what a poem means is simply—itself. No doubt there is such a as quite uncritical composition in literature ; no doubt there is such g as quite uncritical enjoyment. But both must be very rare. As soon nan becomes aware that it would suit his purpose to say a thing this ather than that, as soon as a man becomes aware that he likes this better than that, criticism begins : which is as much as to say, that ism begins when literature begins. But criticism as a noticeable ty in literature begins when vague instinctive preference passes into iously defined choice which can be rationally justified : when, that ay, there is an appeal to intellectual principles. What is to be gained ch an appeal ? Ultimately, simply this : the gain of being intelligent. ever man can think about at all, some men will insist on thinking with the most conscientious precision and lucidity that can be ved. But there is a more obvious reward. Criticism enables the man as the energy to create literature, to make the most intelligent, and ore the most efficient, use of his energy ; and just so criticism en- the man who has the capacity to enjoy literature, to make his enjoy- the most intelligent, and therefore the most discriminating and most nating, kind of experience.

ticism, as distinct from creation and enjoyment, consists in asking swering rational questions about literature. These questions are of two main kinds, according as they proceed from literature in general to particular pieces of literature, or the other way round. In the first kind of enquiry we regard literature as a certain class of things, and we ask how it is that we are able to take this general view of literature as a whole. What does the word " literature " mean ? What are the properties common to all literature, by reason of which it exists as such ? Above all, what is the function of literature ? The results of this enquiry can be set out in a system of principles which expresses our understanding of the nature of literature. It is important to note that last point. These principles are intellectual principles ; but they are not principles which the intellect lays down *a priori* as prescribing the nature which literature *ought* to have. The nature of literature is a fact which exists, whether we investigate it or not, like any other objective fact. The principles of literature are the answers which our intellect gives us when we ask what sort of a fact literature is.

This kind of enquiry may be called the theory of literature. It only touches incidentally or by illustration on the merits of particular pieces of literature. On the contrary, the merit of this or that particular piece of literature is precisely the topic of the second main kind of enquiry. This is what usually goes under the name of criticism, and may indeed be called criticism proper. The question here is, not of literature in general, but of unique qualities in actual concrete examples of literature : what are the qualities which give to some particular work its peculiar individuality, and whether these are good or bad qualities. Style, in the broadest sense, which includes mood and spirit and the choice of matter as well as technique and language, is the subject of criticism proper ; and its end is to assess literary merit. Only incidentally to this does it touch on the function of literature.

Strictly speaking, the theory of literature belongs to that department of philosophy which is called æsthetics. But the two kinds of enquiry cannot be kept apart ; indeed, no clear line can be drawn between them. The theory of literature must be continually referring to the fact of literature ; which means, it must be continually referring to actual specimens of literature ; and to a considerable degree, these instances will be helpful according to the literary merit they possess. On the other hand, criticism proper naturally prefers to stand on something more reliable than impressions which may be at the mercy of personal prejudices or emotional accidents. The history of criticism has been very largely the history of attempts to formulate rules for criticism, chiefly by comparing the merits of several similar works of literature, and the means used to produce them. But rules derived from some particular instances in one kind of literature do not give the security required. Over and over again such rules have been found wanting. When the number of instances has been enlarged, the rules have broken down. Thus, critics have demanded that epic poems should have invocations or funeral games or supernatural machinery, simply because these qualities occur in several good instances So too the brilliant success of French classical drama induced many critics to accept the rule that drama should observe the unities of time and place. And however many particular instances the rules may be enlarged to include, they can never be safe rules, so long as they are derived from

comparison of meritorious qualities, and not from the intellectual
ciples of the theory of literature. For you can never be sure that such
ities, however meritorious, are essential. Only the principles which
ess the nature, and define the function, of literature in general can
rmine what is essential in any kind of literature ; and only by appeal-
o what is essential can criticism provide itself with trustworthy rules.
hus the two kinds of rational enquiry in literature, which we have
d the theory of literature and criticism proper, necessarily overlap.
her can complete itself without involving the other. Even if we con-
the word criticism to the assessment of merit, there can be no security
is unless its analysis can appeal to intellectual principles. For our
oses, therefore, it is right to include the theory of literature under the
ing of criticism. We shall proceed by discussing several works of
tanding importance in the history of criticism, whether their motive
philosophical (the theory of literature) or æsthetic (criticism proper).
mplete history of European criticism cannot be attempted. Our at-
on will be chiefly given to those philosophical treatises which are
cially valuable to æsthetic criticism, and to some critical enquiries
rtant in the process of English literature. The chief place will be
pied by a discussion of the first and most celebrated of all systematic
ries of literature, Aristotle's *Poetics*. We shall discuss this great
ise, not for the way it exemplifies the culture in which it originated,
for its contribution to all subsequent culture. And we shall discuss
length because in it Aristotle raises almost all the problems out of
h emerge the principles required by criticism for its security,
otle does not always solve these problems satisfactorily ; but he com-
us to consider them exactly. But first of all it will be advisable to take
eral view of the rational examination of literature.

II. THE ART OF LITERATURE

terature is an art by which expression is achieved in language. As a
minary description, that statement will do well enough ; but it is
ntly inadequate as a definition of literature. Not everything which
t come under that description would be called literature—not, at
if the word literature is to retain any precision of meaning : and
we allow a word to become vague in its meaning, we deprive it of
efulness. Thus, conversation is not literature ; and yet we speak of
t of conversation. The word *art*, in fact, appears to have many mean-
besides the so-called fine arts, we speak of the art of cooking, the
war, the art of advertising, and a hundred other arts. But the word
e same core of meaning in all its contexts : it is always skill definitely
eliberately designed to produce an intended result. Clearly, then, we
t rely on the word *art* to define what we mean by literature ; if we
pted to do so, we should only beg the question, and say, in effect,
rt here means the art which produces literature. On the contrary, we
nly define what we mean by art here when we know what we mean
rature. Certainly, there are degrees of skill ; we may easily admit, that
rature there is a higher degree of verbal skill—more studied, more
tent, more intent—than in conversation. Moreover, in literature,

the skill is *only* in words : in conversation, the skill is also in the use of personality—sometimes more than in the use of words. Poetry may be recited, of course, and plays may be acted ; but the literary art is substantially the same whether it is spoken aloud or read in silence.

We must not, therefore, define literature by referring it to the written or printed word. For the word intelligible to the eye is only the symbol of the word intelligible to the ear ; and is in fact *heard* (though it may be only mentally) at the same time that it is visually read. Moreover, in a great deal of literature—in all poetry, for instance—it is as essential to the art of it that the words should be vividly heard (though, once more, they need be only mentally heard) as that they should be understood.

Precisely what we mean by art in the case of literature, then, must be left to appear as we narrow down the idea of literature. Art, we say, is skill designed to produce an intended result. What is the result aimed at in the art of literature ? We have described literature as a species of expression. But this is only one side of the business. Literature exists not only in expressing a thing ; it equally exists in the receiving of the thing expressed. If I tell you of something I have experienced, my words, on my side, *express* my experience ; but on your side, my words *represent* my experience. It would be just as true, therefore, to say that literature represents things as to say that it expresses things. The possibility of regarding literature in either of these two directions has influenced not merely criticism, but literature itself. To regard literature as the expression of its author's mind (or mood or temperament) emphasizes the subjective element in it, and thus leads ultimately to romanticism ; in which what the author felt is the important thing. The opposite way of regarding literature, as a method of representing things to the reader, emphasizes the objective element, and thus leads ultimately to realism ; in which the substance exhibited is the important thing. Both of these aspects are true ; but neither is the whole truth. For the theory of literature, we require a word that will include both these aspects on equal terms ; and the simple word *communication* will give us exactly what we want. For evidently, whatever else literature may be, communication it must be : no communication, no literature. Though we are apt to speak as if the mere existence of a piece of language could constitute literary art, we must always remember that language is only the medium of the art. The art consists in the communication established between author and reader (or, of course, hearer). Clearly, then, what we mean by literature will be given by the *kind* of communication which this art sets up.

When we speak of the art of literature, then, we imply the existence of a series of three terms : the two extremes are author and reader ; the middle term is language. That is what it means to say, literature is communication. But we need not banish the words *expression* and *representation* (or *imitation*, which contains the same notion as the latter word : of imitation we shall hear much later on). On the contrary, they are often very useful words ; *expression* especially useful just now, when the question must unavoidably be, what kind of communication does literature set up between author and reader ? But whenever we use them, it will always be understood, that expression has achieved a form *communicable* to another mind, and that representation has arrived by being *communicated* from her mind. The importance of this, in the theory of literature, can ly be exaggerated.

e are at once struck, when we survey the studied and deliberate use nguage, by the fact that sometimes we can approve of the language he way it conveys something the worth of which can be judged quite t from the language; and sometimes our approval of the thing cond cannot be distinguished from our approval of the language conveyt. In either case, we have an art. But in the first case, we have an art h exists for the sake of something justifiable outside the art itself; in other case, we have an art which exists, as it seems, simply for the of existing as art. The first we may call *applied art*, the second *pure* and we may illustrate the difference by contrasting *The Origin of ies* with the *Ode on a Grecian Urn*. Both Darwin and Keats, we may wrote in order to express themselves. But Darwin expressed himself he purpose of putting his readers in possession of a certain body of rmation, and of thereby persuading them of the cogency of a certain of argument. We judge his power of expressing himself as it enabled to achieve these purposes; but we do not judge these purposes by ower of expressing himself. We ask whether the information is true, her the argument is reasonable; the virtue of the expression consists e way it enables us to ask these questions, to make these judgements. e expression were clumsy, the information might nevertheless still be and the argument reasonable; but it might be more difficult to arrive ese judgements. The purpose of *The Origin of Species*, then, is *served* e literary quality of the book (" literary quality " meaning, at present, rding to our preliminary description, simply expressive power); but not *justified* by this literary quality. We can distinguish, therefore, the t of Darwin's purpose from the merit of his expressive power.

t in the *Ode on a Grecian Urn*, what purpose can be distinguished its expression? It offers us no information which may or may not be no argument which may or may not be reasonable; neither are we ed to consider whether it is useful or moral. This is expression which fies us simply by existing as expression. The art here does not uct us to a position from which we can judge of something outside rt; this is art which serves no purpose but to be itself, and which pts us to judge of nothing but of itself as art. In this sense the art is ; and when we speak of literature, we either mean that the art is in sense pure, or that we are regarding it as in this sense pure. For it is ble to consider *The Origin of Species* as literature; but only by ding to Darwin's power of expression as such, disregarding or taking ranted the purpose he aimed at. The case would be even clearer in a of history. It is, in fact, very easy to read, say, Gibbon's *Decline and of the Roman Empire* without much concern for the accuracy of his or the justice of his interpretation, taking it merely as a magnificent of events presented to the imagination. If we do so, we take it as a of pure literature, expression justified simply as such. Thus, by *ed literature*, we mean work which can be regarded as literature by ing its author's purpose: what he intended as a means to an end, we as an end in itself. But in *pure literature* no such exclusion of the r's purpose is required; for there never was any purpose except that the expression should exist for the mere sake of existing as itself. Our discussion of the art of literature, then, will concern itself wholly with pure literature, with the expression which justifies itself by the mere fact of existing. Whenever we speak of literature, we shall mean pure literature. Applied literature we shall ignore—anything which was written to give information or to make argument persuasive, any expression designed to serve a purpose beyond the mere achievement of expression as such. We shall ignore all this for two reasons. First, because whatever expressive qualities may be found in applied literature, may be much more easily and more demonstrably found in pure literature, along with a much greater range of such qualities. Secondly, because the principles to which criticism of these expressive qualities must appeal will most naturally reveal themselves when expression has to rely solely on itself for all its justification, being actuated by no other purpose than to exist as such.

But when we say the art of literature is expression, we mean communicable expression : more precisely, we mean that the artist, in expressing himself, communicates with someone else. What does he communicate? In the case of Darwin, the answer is obvious ; he gives us facts, and a theory. But what does Keats communicate ? When expression justifies itself simply by existing as such, what is communicated then ? The answer can only be, something which, unlike Darwin's message, justifies itself simply by being communicated. And if we go on to ask, what sort of a thing is that ? again there is only one answer : *experience*—experience which is accepted and valued simply because it is experience. So accepted, we may call it *pure experience*. The epithet really adds nothing ; for by the very nature of experience, it can never be anything but purely itself. But we are not always satisfied to take experience at its face-value. We may ask whether it is true or reasonable or useful or moral. If I am looking at a landscape, I may, if I am a farmer, judge what I see in accordance with familiar practical values : I may ask myself whether I am looking at good farming land. On the other hand, I may be perfectly satisfied with the experience of looking at the landscape without asking any questions about it at all. I am merely aware that the landscape is *beautiful*. And whenever I am aware of that, I experience something which is wholly satisfactory by the mere fact of being experienced. Now if I express this, my expression of it will have no purpose but to exist as such ; and if my expression is communicable in language, I shall have achieved literature : I shall have communicated something which can be satisfactory simply because it has been communicated.

The matter of literature, then, is pure experience. This puts no restriction on the scope of literature. Nothing can happen in life that cannot be taken as experience valued for its own immediate sake. Though we are not always satisfied to accept experience at its face-value, it is always possible to be so satisfied, provided the experience is comprehensible. The possibility of pure experience in sensuous or emotional life is obvious; but it is equally possible in intellectual or any other life. We can enter into and enjoy a train of reasoning simply as an intellectual experience, whether we are convinced by it or not. There are few things more satisfactory in themselves, more supremely beautiful, than the structure of Spinoza's philosophy : but its beauty is one thing, its truth is another.

ɔ indeed can tell whether it is true? But anyone who can understand it know its beauty. And how often in literature do we not accept moral eligious conditions which we would never think of accepting in real ? We accept them simply as experiences. Even when we experience ething which we feel bound to judge, not at its face-value, but for its h or reasonableness, its morality or utility, the very act of so judging an be intuited as experience, and enjoyed for its own sake. Thus, rever there is life, there is the possibility of pure experience, and so of ature. This gives another explanation of applied literature. We have ı that *The Origin of Species* can be regarded as literature if we ignore win's purpose, and simply regard for its own sake the expression he gned to serve his purpose. But besides excluding the author's purpose, nay also transform it : that is to say, we may take it as an enjoyable bition of purpose. That is how Spinoza's *Ethics* may be regarded as ature.

ut in pure literature we need neither exclude nor transform : experi- e there is *expressed* as enjoyable merely by virtue of being expressed. s the effect of the author's intentional art both that we have the erience and that we enjoy it. This is what we mean when we say that matter of such literature is pure experience. We may illustrate it her by contrasting Darwin with Lucretius. Both Darwin and Lucretius us elaborate argument embodied in a mass of facts, inviting us to ept the argument as reasonable and the facts as true. Darwin's mode of ression gives us nothing else : it is expression designed to serve a ely scientific purpose, and is literature only in so far as the expression be judged as such, taking its purpose for granted. The art of literature ot concerned with the theory of natural selection ; it is only concerned ı the art which puts that theory before us. This we call applied ature ; but the poem of Lucretius we call pure literature. Why ? ause Lucretius expresses not merely a theory, but the experience of orizing. His language certainly puts us in possession of his arguments his facts ; but it also puts us in possession of the ardour and exulta- with which he works his arguments out, the relish with which he es on his facts. Whether his doctrine convinces us or not, we enter, ve read him, not merely into a philosophy, but also into the experience being a philosopher, the sublime experience (to which intellect, tion, and sense all contribute) of encountering things with an under- ding that feels itself equal to them.

his brings us to a most important principle in the theory of literature ; eed, out of the apparently simple proposition that literature expresses e experience, all the main principles of our theory proceed. And first es this : the importance of combining the ideas of expression and esentation in the larger and livelier idea of communication. The hor, at his end, expresses an experience in language ; to the reader, at other end, language represents an experience. Neither of these terms y declares what literature is. For literature *communicates* experience : is to say, the experience which lived in the author's mind must live n in the reader's mind. It is not enough to give the reader *what* has n experienced ; neither is it enough to give him *how* the experience has n taken. The experience itself must be given, transplanted from one mind to another. I do not give you my experience of looking at a landscape if my words merely represent what I have seen, nor if they merely express my feelings : if this experience is to be matter for literature, it must be the experience whole and entire, both what I saw and what I felt in perfect combination.

For the matter of literature, nothing else is required ; but nothing less. Attempts have often been made to say what sort of matter is suitable for pure literature, what sort is unsuitable. Anything whatever is suitable matter for the art of literature, provided it is taken by the author as experience enjoyable for its own sake, and so given to the reader ; nothing whatever is matter for literature, unless it can be so taken and so given. Anything can be so taken ; but not everything can be so given. That must depend on the author's (or would-be author's) power of making language his communication. But how can language communicate experience ? It is time to look a little more closely at this. And when we do so, we cannot but see that to speak of language communicating experience is a somewhat elliptical way of speaking : though not quite so elliptical as might at first appear. Nothing can be more privately and peculiarly one's own than one's experience : it is the very process of one's life, and by no possibility can any person share his own individual life with another person. But my life can *imitate* your experience—by imagining it ; and in the case of literature, the imitation will be of the same kind as the original. For the art of literature deals wholly with the kind of experience which is, not necessarily imaginary, but certainly imaginative. The originating impulse which prompted literary composition may derive from any of the infinite possibilities of life : it may be purely imaginary, or absolutely actual : the author may have dreamt a dream, or he may have fallen in love. But whatever it was, it must have become imagination : in order to put it into words, the author must catch it out of the flux of life, and hold it distinctly before him. That is to say, he must continue its existence by making it continue in imagination.

Now, for an author to communicate this means that he must arouse a similar imagination in his readers. By means of words, he must not only set imagination working in his readers ; he must also, by his words, control his readers' imagination, so that their experience may, as closely as possible, *imitate* his own. But in order to do that, he must make these very words (in a somewhat different sense) *imitate* his experience : he must make them a *symbol* of his own experience, always governing this not only by his sense of expressing himself in the symbol, but also by his understanding of his symbol's power of representing his experience to his readers. If the language he uses does not represent his experience to his readers, no matter how clearly it expresses this to himself, it does not succeed in being literature : it does not succeed as communication.

For language, in literature, must always be symbolic. Literature communicates experience ; but experience does not happen in language. The author's experience must be translated into such symbolic equivalence in language that the symbol may be translated back again by the reader into a similar experience : in both cases, the experience being imagined. Now this symbolic medium, language, is a limited medium.

there is no limit to the possibilities of imaginative experience. The f literature, then, is the art of using a limited medium as the symbol ılimited possibilities. Hence it is that the literary artist must know to combine in his art every power he can find in language which be both expressive and representative : whatever can be *communi-e*, in the sense of simultaneously stimulating and guiding imagina- The language must be expressive, for it must be the author's own rience that is transmitted ; but it must also be language that can esent experience, for otherwise this will not arrive in the reader's l. The business would be easy, if it were true that whatever is expres- is thereby also representative. But this is not true. An exclamation be very expressive to the man who exclaims ; but to the man who s it, it may represent little or nothing. An author may be tempted vent new syllables, which to him may exactly express his mind : he invention will have nothing to do with the art of literature unless liberties unmistakably represent his mind to his readers : which are not very likely to do.

evertheless, language in literature must be made to mean very n more than the logical or grammatical meaning which is given by ntax—the orderly arrangement of its parts. In fact, literary language rs from ordinary language precisely by the conscious and deliberate in it of powers additional to the force of grammatical meaning : ers which are only casually employed in common speech. *Thought* t expressed in literature for its own sake, but for the sake of the nisation it gives to experience. Not only thought, but equally ions, sensuous impressions, psychological intuitions, and the mass nfinitely variable associations that accompany the movement of ght, must also be communicated to the reader's mind : that is to experience itself, by being imaginatively provoked there. Thus, as ave already noticed, something infinitely variable (experience) must ommitted to a notation (language), the capacity of which is, by its nature, limited. Literary art, therefore, will always be in some ee *suggestion* ; and the height of literary art is to make the power of estion in language as commanding, as far-reaching, as vivid, as e as possible. This power of suggestion supplements whatever ıage gives merely by being plainly understood ; and what it gives is way is by no means confined to its syntax. But for conveying the and, perhaps, the most individual qualities of his imagination, the r must rely on his readers' ability to respond to what his language nly suggest. Socrates derived the power of literary creation from a in *special nature*, which he described as being capable of " enthu- ." This is true enough ; but " enthusiasm " is of no avail without ower to express it intelligibly in words. It is the *sense of language* distinguishes the literary artist from his fellows : and the supreme of this is knowledge of what language can be relied on to suggest. so it is the sense of language, proved by ability to respond to the stions of language, that makes the enjoyer of literary art. This is *pecial nature* which, active in the creator and passive in the enjoyer, ust assume as the prime specific condition of literary art.

the medium of literary art, the communicative power of language is of four main kinds. These, of course, are only separable in a theoretical analysis : actually, they are all inextricably involved in one another. They are all capable of being unmistakably understood, though this property belongs most obviously to the first. They are all capable of an endless range of suggestion, though this may seem peculiarly noticeable in the other three. Language consists of the meaning of words and of the sound of words. These are the two aspects of one essentially indivisible combination ; but each aspect can be separately attended to. And each of these can again be subdivided into two. Of the meaning of words, there is first the grammatical meaning of the sentences given by the syntax. This is the structure of language, and represents thought as the structure of experience. But every individually significant word may have, independent of its grammatical force, a peculiar *value* for imagination, derived from its context. For what a word means is by no means a simple affair. The meaning which the dictionaries give is not much more than the nucleus round which clusters a whole system of secondary meanings. The nucleus of meaning stands for a certain thing or action ; the secondary meanings indicate the various ways the thing or action can occur. A very large part of literary skill consists in vividly liberating for its effect on imagination just that particular secondary meaning in words which is not only appropriate to the immediate occasion, but which will make the occasion come to life in the reader's mind.

The meaning of words is inseparably conveyed by their sound ; but in addition to this, the sound of words can be made significant on its own account. There is first *syllabic* sound—the quality of the vowels and consonants in distinct syllables, or in sequences of syllables, brought out by contrast or by repetition. This includes, besides rhyme and alliteration, those subtly significant effects by which vowels or consonants, sounding against each other, become sometimes plainly imitative, more often indefinably but irresistibly suggestive. Secondly, there is the *rhythm* of language : not the *quality* of the sounds of syllables, but the undulation of the *degree* of sounds in whole sentences. The degree may concern strength, duration, or pitch of sound ; and the undulation is rhythmical in so far as it is a recognizable alternation of any or all of these variable degrees of sound. Rhythm is, no doubt, the most valuable use in literary art of the sound of words ; since for the most part it is rhythm which conveys the emotional atmosphere, without which experience could not live.

By considering language, then, first as meaning, and secondly as sound, and by subdividing each of these aspects into language in continuity, and language in individual words, we see that the art of literature can avail itself of a fourfold power of communication : (1) in sentences of language, there are (*a*) the syntax of the sense and (*b*) the rhythm of the sound ; (2) in individual words, there are (*a*) the imaginative value of the sense and (*b*) the syllabic quality of the sound. Thus, in the line

Crossing the stripling Thames at Bablockhithe,

the meaning of the phrase as a whole is given by the syntax, and the rhythm of it by the alternation of unstressed and stressed syllables ; while the imaginative value of the word " stripling " here is unmistakable, the quality of syllabic sound in the sequence of consonants and vowels *ripling, Thames, Bablockhithe* is equally noticeable and effective (the estion of the sound of flowing water is obvious).

l four kinds of power need not always be simultaneously employed, nployed with anything like the same degree of importance. The art erature is often divided into prose and poetry. This is undeniably enient; but the division cannot properly be made hard and fast. n it is so made, it is found to depend on nothing more than the ence or absence of a particular kind of rhythm, which we call metre. verse (or language disposed in metrical rhythm) is notoriously no antee of poetical language; and poetical language (as in the Author- Version of the Book of Job) can exist very well without verse: etrical rhythm may often be the right rhythm for poetical language. without some such definable criterion as verse, what is poetical uage shades off into what is not poetical, by quite imperceptible ees. The distinction, then, is only valid in a very broad sense, and is tical rather than philosophical. But it would not be even practical ss "poetical language" meant something. What does it mean? eans language which is capable of communicating the peculiar acter of an author's experience with the most penetrating vigour, inest definition, and the subtlest detail: it means language raised to eight of its power, language in which the utmost appropriate use is ltaneously made of all its four kinds of communication. It is true in the vast majority of cases, when the desire is to communicate tly every instant of experience in its immediate intensity, the peculiar tence of metrical rhythm is employed. But metrical rhythm is not essential thing.

e word *poetry*, then, so understood, may very well stand for literature eneral, in our discussion of literary art as a whole. For poetry is the nce of literature; in poetry, the whole business of literature, the munication of pure experience in language, is concentrated to its ost intensity. Whatever is true, on general grounds, of poetry, will rue of literature as a whole; and whenever our theory speaks of ry, it will be of poetry as the type of the art of literature.

e end or aim of that art is to express, to represent, to communicate. ature is not composed in order to be beautiful: we judge it to be tiful when it has succeeded in its aim. Just as we judge the pure rience of looking at a landscape to be beautiful, so do we judge the experience of receiving the communication of literature: for the rience of receiving the communication and the experience com- icated are indistinguishable. But we have not yet completed our ssion of the art of communicating experience in language. We may e many things in the texture of a poem to be beautiful; and we may e the poem as a whole to be beautiful. But the beauty of the whole t merely the sum of the beauty of the parts. So far we have been unting for the *matter* in a work of literature; we must now speak *form*—that which enables us to judge the work as a whole. We find that the form of literature is just as important as its matter. form that gives the answer to the question, What is the function of ture?

We have seen that every work of literature originates in an experience. It may be any sort of experience : something may have happened to the author in actual life, or he may have heard a story of something, or some fantasy may have flashed into his mind. But it must be an experience peculiar in one respect : it must be of a kind to take hold of him and to demand utterance. There might be nothing extraordinary in an experience that merely urged him to express himself ; there must be something extraordinary in any experience that urges him to express himself to perfection, and in a way that will also represent his experience to another mind : in a word, that insists on being communicated. For this means the energetic exertion and strict discipline of effort, in order to produce in language a symbol of the experience that shall be as nearly as possible exactly right to his artistic conscience. What is his artistic conscience? Nothing but the experience itself demanding its just equivalent in language : a severe taskmaster, to which the artist willingly subjects himself. And what peculiarity must the experience have, to give it this tyrannous power over the artist's mind? The answer seems to be, a peculiar degree of intensity. Perhaps all experience demands expression ; but only a peculiarly intense experience demands that remarkable kind of expression which takes the form of artistic communication, seeking thereby not merely to proclaim its occurrence, but to proclaim *itself* : so to declare its very nature and substance and tone that it may come to life again in other minds.

Now, intensity of experience means intensity of attention to it. We may call an experience, which possesses this power of dominating and energizing the artist's mind, the *inspiration* of the resulting work of art : a useful word, so long as we confine it to this quite precise meaning. In this sense of the word, the rule is, that the greater the inspiration, the greater the art required to give it literary expression ; for the more there is in an experience, the more power over language will be required to symbolize it in a work of art. It is plain that the writers—Homer, Dante, Shakespeare, Milton—who can give us the greatest experiences, can do so because they are the writers who have the greatest command of expression in language. Of course, they had great inspiration ; but we should not know that if their language had not been adequate to it. The richer the substance of their experience, the richer they could make the texture of their poetry : but that was because of their power over language. It was not merely, however, the wealth of substance in it that made their experience an inspiration ; it was because this wealth of substance was attended to in a single intensity of experience. When Shakespeare heard (or read) the story of *Othello*, he took it as a single experience ; the whole matter and import of the tale was seized by him in a single act of imaginative attention. The wealth of matter in this experience of his is expressed by the texture of the play ; but the final impression of the completed play brings all this wealth of matter in our minds into a single intensity of experience, a single act of imaginative attention, the excitement of which corresponds (so far as we are able to correspond) with the energy of Shakespeare's inspiration.

Experience can never be simple. It must always at least unite what is given to a mind with what is given by the mind ; and both of these be complicated. Suppose a man is looking at a sunset. His senses ot only give him the glory of colour and the delight of shape ; they also him, perhaps, the coolness, the quiet, the fragrance of the moment. to these he adds, perhaps, imaginative associations of his own : hat the appearance of fire means to him, all that is suggested by the of day, the coming of night, the transitoriness of beauty, and so on. his is united in a single experience ; all this is collected in a single f attention. If the moment has the intensity which demands artistic ession, it will be picked out of the flux of experience, isolated, and e to persist by being continued in imagination ; and by the very act eing imagined, it will be still more enriched. Now what characterizes experience is not merely the substance of which it is composed, but unity in which this complex substance is held by imaginative atten- And if this experience is to be communicated *as such*, not only must ature symbolize its complex substance, it must also symbolize the liar unity in which that substance has been held by the author's ginative attention : the very unity, in fact, which made it his inspira-

hat aspect of literature which symbolizes the substance of the nating experience we may call its *diction* ; the aspect which sym- es the unity of the substance in a single act of comprehensive tion we call the *form* of a piece of literature. Form is not imposed liction by some sort of external application ; form arises out of on, when the diction truly corresponds with its inspiration. Never- ss form in literature is an aspect of it as distinguishable from diction e meaning of language is distinguishable from its sound : and it is ortant both in theory and in criticism that the distinction should be e.

nce experience cannot be directly transferred from one mind to her, but can only be communicated by a symbol, and since in ature the symbol consists of words and combinations of words which uccessively put together and successively understood, it follows that irst thing to do in communicating an inspiration is to disintegrate nity into the parts of which it was composed, and that the first thing appen in receiving an inspiration must be to take in the parts of it emeal. But the artist in thus putting forth his inspiration must ide, all the time he is doing so, for the reintegration of its parts once into a unity, when the process of their succession is finally complete ; at the mind that receives his art will have received a series of impres- in a certain shapeliness of succession that will give, at the moment the series is complete, a *form* to the mass of his experiences, whereby e successive impressions unite in a single organic whole.

form in literature, thus considered as the symbolic equivalent of haracteristic unity of inspiration (as diction is the equivalent of its cteristic substance), the importance appears when we ask, What is unction of literature ? To what end is this communicating of pure rience in plays, poems, and novels ? What do we gain thereby, if not gain information, nor persuasion of the truth, the moral worth, tility of things ? It might seem a sufficient answer simply to say, we gain experience ; and since it is *by* experience, and primarily *in* experience, that we live at all, to gain experience simply as such is a gain in being alive. But this would put literature in competition with actual life; and literature can never compete with actual life in the mere provision of experience; for literature can never be anything but imagined experience, which, in competition with actuality, is always under the grave disadvantage of, precisely, not being actual. It is when we look to the form of literature that we see the remarkable advantage over actuality in the experience which literature can provide. For it is the nature of man never to be satisfied with himself simply as the being that experiences; the whole of his practical and speculative effort is to make, or to discover, significance in his experience. Now, in literature, we do not need to make, or to discover, significance in our experience there; experience there *is* significant, simply by virtue of being literature.

And that by reason of the *form* which literature gives to experience. Our practical and speculative efforts are always to advance towards the perfect significance of life as organized fact, or philosophic truth, or moral value, or convenient utility; but they never arrive, and they never will arrive. There is no advance in literature. If literature succeeds in coming into existence, the experience it gives us is thereby significant: it was so when first it was composed, and will be so for ever. If the experience is not significant, literature has not succeeded in coming into existence.

For what is this most fundamental of all man's desires, the desire that his experience should be significant? It cannot be, that experience should have a meaning outside itself: what meaning intelligible to us could experience have outside itself—to us who cannot pass beyond our experience? It can only be, that experience should have a meaning within itself. But what do we mean by "meaning"? Simply, the inevitable relation which one thing has with another. A thing is said to be full of meaning, when it is a focus of relationships with many other things. Experience is perfectly significant, when everything in it is a focus of relationships with everything else in it. It is our nature to detest that kind of experience in which things are incoherent, and happen (or seem to happen) independent of the rest of things—or, as we say, *by chance*. Significant experience is experience in which nothing happens by chance, but everything happens in complete coherence with the rest: everything there exists not only for its own sake, but also for the sake of the whole: the whole is implied by the manner in which everything occurs in it. Each part is more than itself; for it *means* more than itself—it means the furtherance of the organizing of a whole manifestly ordained.

Now this is exactly what experience is in literature. In a work of literature—poem, play, novel, essay, or whatever it may be, so long as it truly is literature—nothing happens that does not somehow contribute to the form of the work as a whole, to the finally unified impression of all the sequence of impressions it has given us. This is, certainly, a limited experience, for it corresponds with that experience which the author's imaginative attention seized on and isolated out of the flux of things, and maintained as an inspiration. But precisely, of course, because it is so limited has this experience the unity which gives it significance. Now it is possible that many people, who have not the literary artist's

er of expression, may nevertheless have moments of experience of a
re similar to his. But in literature we can all have them whenever we
t. Moreover—and this is the important point—in literature the signi-
ice is given to us in a way that makes it much more noticeable than if
me in an instantaneous intuition of actual things. The literary artist
to build up in his symbolic medium, gradually and deliberately, the
nic unity of his work. Hence, when we live in a work of literature,
ive in a series of impressions, every one of which we feel is contribut-
to the final impression of the *form* of the work as a completed whole.
live in experience which we know is ordained to be, however complex,
st a unity. When we have the form of the work as a whole in our
ds, we have the unity of all the experience it has given us ; and having
unity, we have our experience organized in perfect interrelationship ;
have what the whole manner of the work has made us expect and
re : we have, on a greater or lesser scale, experience that is completely
ificant. This is the kind of experience we are always hoping for ; but
in art do we get it : not merely a flashing accidental moment of uni-
experience, but a prolonged continuous series of moments securely
infallibly organizing their own perfect system of interrelationship,
thereby manifesting the only significance which is absolutely neces-
to our minds—the revelation of law and order in things. The
ny of this is chance ; only in art are we safe from the enemy.

ere, then, is the function of literature : and to find it we have not gone
ond the sphere of literature, *pure experience*, judged simply for what
in itself. To say that the function of literature is to teach us or con-
e us or make us moral is to step outside the literary art. Literature can
hese things, but it is not by virtue of doing them that it is literature.
ther is it the function of literature to be beautiful ; we should rather
one of the things we may judge to be beautiful in literature is the way
hieves its function. That function is, by its expression of experience
uch, to make experience significant as such without our having to
e it as true or real or useful or moral. Every work of literature,
igh the experience it gives us is necessarily limited, provides us with
nstance of the experience we most profoundly need : and that by
on of its form. It is form in literature that makes experience there
ificant. But it is obviously incorrect, though it may be convenient,
peak of significant form. Form itself cannot be significant. Form can
exist as the form of substance ; and the significance given by form
gnificance which form gives to substance. That substance, it is true,
ot actual substance. But in actual experience, we can never know com-
e and secure significance. If we wish to know what that is, we must
ontent with imagined experience. But the perfect significance we find
he imagined life of literature is a continual incentive to the noblest
eavour of actual life : the endeavour to attain, practically or intellec-
ly, as much significance as may be.

will be useful to conclude this section by recapitulating in a tabular
mary the main principles of the theory of the art of literature.

The art of literature is the art of communicating in language experi-
valued as such and enjoyable for its own sake.

For this, it is not enough to communicate either the matter or the manner of the experience : it is not enough to express the subject of the experience, nor to represent the object of the experience : it is the experience itself, whole and entire, both the object and the subject, the thing that happened and the mind to which it happened, that must be communicated.

3. Since the experience did not happen in language, language can only communicate it symbolically ; the power of language to symbolize experience depending on its power to stimulate imagination. Whatever the experience may have originally been, it must always be communicated as imagination.

4. In order to symbolize experience as completely as possible—that is, to provoke the most complex imagination possible—literature makes appropriate use of every power language has of affecting the mind, both on the semantic side (or the aspect of meaning) and on the phonetic side (or the aspect of the sound of language). The power of language over the mind is fourfold :

> Semantic : the construction of the meaning in syntax, and the imaginative value of individual words ;
>
> Phonetic : the construction of the sound in rhythm, and the quality of individual syllables.

5. An experience is characterized not only by its substance, but also by the unity in which its substance is held. To communicate an experience is therefore to communicate both its substance and its unity. The diction of literature symbolizes the substance of the experience inspiring it, the form of literature symbolizes the unity of this. In order to commit experience to the communication of language, it must be disintegrated ; but as the communication progresses, there must be a governing tendency towards a final re-integration into unity. So that as the series of impressions goes on, the diction designs itself as form ; and when the diction is complete, the form is achieved.

6. When the whole series of impressions can be seen as constituting a single shapely form, and therefore as a unity, everything in a work of literature is understood as existing in perfect interrelationship. Nothing is there by chance ; nothing is there unless in the interest of the whole. This is that significance in experience which we desire above all things. To provide us with vivid imagination of significant experience is the function of literature.

III. ARISTOTLE'S "POETICS"

Aristotle's treatise *Concerning the Art of Poetry*, usually called the *Poetics*,[1] was never meant by Aristotle himself to be a treatise. Like almost everything else of his that has survived, it was not composed as a book ; it merely represents the lectures which he used to give his students. It may be the notes which he himself set down for his own guidance ; it may be the notes which some student or students took of his res ; it may be a mixture of both. Whoever committed it to writing ot do so for the public to read. It is abrupt, disjointed, awkwardly as awkwardly digressive ; essential ideas are left unexplained, intial things are elaborated. In short, it has all the literary defects of e notes. The most important conception in it, the intellectual centre l which everything else is organized, is never defined ; it is men- d by a technical term (which is not only metaphorical, but ambigu- metaphorical) and is frequently alluded to ; but we have to make s best we may, what Aristotle means by it. This is exactly what one t expect of lecture notes. The central idea of his system was precisely vhich least of all needed to be written out in full : precisely that on h he could trust himself to lecture without notes.

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[1] Good English translations are Butcher's (Macmillan) and Bywater's (Clarendon Press).

spite of all these defects, the argument majestically reveals itself : he argument is such, that the *Poetics* is not only the first thoroughly sophical discussion of literature, but the foundation of all subsequent ssions. It is, of course, the product of its time ; a fact which is most usly apparent in the limitation of its subject matter ; for literature eveloped in many directions since Aristotle's time. It is fatally easy iticism to go wrong, when it is restricted, or restricts itself, to a few and fashions in literature : it is fatally easy to take the inessential e essential. But Aristotle had the conscience of a philosopher. With discussion of the problems of literary criticism, however restricted ope, could not but be a truly philosophical discussion. What was philosophy in Greece in the fourth century before Christ, is good sophy everywhere and in every age. Much of what he says illustrates thought and concerns Greek literature ; but much of what he says essence of right thinking about literature in general. In many re- s, nothing has been added, and so far as one can see, nothing ever be added, to what Aristotle had to say about the art of literature. , though it must always be important to consider the *Poetics* as ging to Greek culture, for us the important thing is to consider the simply as an exposition of the principles of literary criticism, as for Shakespeare and Milton as for Homer and Sophocles. Nothing be more misleading than to attribute to Aristotle modern ways of ht and feeling ; nothing could be more illuminating than to test rinciples by applying them to modern expressions of thought and g.

e subject matter of the *Poetics*, as the book has come down to us, merely restricted to Greek literature, but to certain kinds of Greek ure. These are four in number ; and Aristotle groups them in according to their historical and æsthetic connexions. He supposes to begin in two kinds, as the originating motive of all poetry d, by its very nature, to diverge in two directions. Poetry, namely, either as heroic or as satiric poetry : but out of heroic (or epic) develops tragedy, out of satiric comes comedy. Since, then, the of poetry thus disposes itself into two pairs of kinds, the principles or epic will, with the proper modification, be valid also for tragedy, valid for satire will be similarly valid for comedy. But Aristotle re- d the historically later kind in each pair as a higher development of art, and as therefore requiring fuller discussion than the earlier kind. Accordingly his scheme is to work out the theory of the later development, and then, adapting it to different but closely related conditions, to apply it to the earlier kind. But the *Poetics*, as we have the book, is not complete. The scheme of the discussion is unmistakably indicated; but actually we are only given the discussion of tragedy, and the application of its results to epic poetry. There can be no doubt that the original treatise contained a second part, now lost, in which comedy and satire were similarly treated.

Broadly taken, this scheme of Aristotle's is sound enough. But it must always be remembered that the division of poetry (or literature in general) into kinds or species, though the demarcation may be sometimes very obvious, is in the last resort only commendable as a convenience of discussion. It is not like the division of animals into species : there are no biological boundaries in poetry. Aristotle sometimes forgets that to condemn a composition as a tragedy is not necessarily to condemn it as a poem. It may have seemed, by certain apparent signs, to resemble tragedy; but the real purpose may have been something quite different. It is also possible that the species " tragedy " may have been too rigidly defined. But what is more likely to strike a modern reader, in this scheme of Aristotle's, is its complete omission of lyric poetry. This is not likely to be due to inadvertence. Neither is the cause of this likely to have been, that lyric poetry would not fall in well with the sort of argument to which Aristotle's philosophical tendencies inclined. On the contrary, lyric poetry would have given him invaluable aid in making out his central proposition. The thing probably was, that for Aristotle lyric poetry was inseparably bound up with music ; just as for most of us to-day " Drink to me only with thine eyes " or " Auld lang syne " only exists as a poem in conjunction with its melody. Lyric poetry would therefore scarcely fall within the scope of his topic ; for he expressly limits the art of poetry to the medium of language. What we have, then, in Aristotle's *Poetics*, is really the theory of tragedy, with the modification of this to cover epic. But the theory of tragedy is worked out with such insight and comprehension, that it becomes the type of the theory of literature.

To a philosopher like Aristotle, whose ambition seems to have been to systematize the whole range of man's mental activity, it would scarcely have been possible to omit so conspicuous a part of it as the art of literature. But almost certainly his argument had another, and perhaps a more keenly urgent motive than that ; almost certainly the *Poetics* is Aristotle's counterblast to Plato's celebrated condemnation of poetry as a pursuit unworthy of man's intellectual dignity, and radically vicious in its effect. In introducing the *Poetics*, therefore, something must be said, however briefly and inadequately, about the difference between these two typical minds ; for, as far as our topic is concerned, out of this difference came the most formidable assault on poetry, and the most effective defence of it, that has ever been known.

Aristotle had been Plato's pupil ; but as his mind matured, he became conscious of a deep cleavage between his convictions and his master's, and felt himself called upon to protest against some of the characteristic conclusions and methods of the Platonic philosophy. Indeed, it would scarcely be possible to pick out two men better fitted to illustrate the two osite poles of philosophic thinking. The difference between the two , very roughly, be indicated by referring to the studies in which they specially interested. Aristotle's philosophy was coloured by his in- st in biology, Plato's by his interest in mathematics. This means that totle's mind liked to proceed from things to ideas, Plato's from ideas nings. Aristotle had the scientific, Plato the metaphysical mind. The importance of this difference between them comes in when the tion is, What is meant by *reality* ? Thus, the biologist may be led by study of actual individual creatures to the general idea of a species of tures, Man or Dog. The idea of a species is real enough ; but it is only because it is the idea of real men and dogs. Biologically speaking, reality of things gives to ideas whatever reality they possess. But nematically speaking, the reality of ideas gives to things whatever ty they possess. For the mathematician studies ideas which cannot erfectly realized in things. The idea of a line is purely an idea, and properties of a line are purely ideal properties. But they are eternal immutable properties, in which the mind may rest with absolute iction. In a word, they are the properties of that certainty of exist- we call reality ; and actual physical lines only possess these properties far as they are able to represent the idea of a line, which they can do approximately. Thus for the mathematical mind things are real gh, but only because they represent ideas ; reality is conferred on gs by ideas ; the ideas would be real even if (as in fact is the case with mathematical ideas) there were no things to represent them.

his digression may seem to have moved a long way from poetry. By perverse logic Plato arrived at his condemnation of poetry, we shall ently see ; but the nature of his objection is quite in accordance with nature of his philosophy, just as Aristotle's answer to that objection rds with the nature of *his* philosophy, and with his antipathy to 's. Aristotle never says that his theory is an answer to Plato ; he never tions Plato in the *Poetics*, and never even alludes to the Platonic ction to poetry. But his whole argument is exactly planned to idate Plato's argument at every point ; and thus falls in with his ly expressed opposition to Plato elsewhere. The difference between wo minds is shown in the way they approach the very existence of ry. It seems a paradox that Plato, who in his youth had done exquisite s in poetry, and in his maturity had such perfect command of ry art that he could present abstrusest metaphysics as an enchanting c of ideas, should have been the man to condemn poetry ; whereas otle, whose extant works can scarcely be called literature at all, ld have directed the full force of his philosophy into the sanest and gest commendation poetry has ever had. But we must remember that otle is not to be judged as a writer by his extant works ; the books by h he might have been so judged have almost entirely disappeared. rtheless, it seems unlikely that Aristotle could ever have stood le Plato as a literary artist. But it was Plato the philosopher who emned poetry ; and the mere fact that he did so is typical of the way philosophy regarded *things*. Things being only important as the sentatives of ideas, he was quite prepared to say that a thing which unnecessary or unworthy as a representative of ideas ought not to exist. Poetry was a thing of this nature ; Plato therefore proposed that it should be abolished. But it was with a biologist's respect for the existence of *things* that Aristotle looked on poetry : for him, ideas were only important as the interpretation of things. It never occurs to Aristotle to ask whether poetry ought or ought not to exist. It does exist : the questions for *his* philosophy are, In what manner and to what result does it exist ? One might perhaps say, Aristotle would no more think of asking whether poetry ought to exist, than whether a species of animals ought to exist. At any rate, the conclusion he comes to is the exact opposite of Plato's opinion ; it is, that the function of poetry can be supremely beneficent. It may very well be that he started with this opinion ; and that to prove it against the great authority of Plato was his chief motive in composing the *Poetics*. The thing is, that his argument arrives at this conclusion by a strictly philosophical process. Aristotle's philosophical conscience ensures that the result would be the same, whether the investigation did or did not begin as a perfectly disinterested enterprise.

But no systematic philosopher can be perfectly disinterested when he investigates a special topic ; he has, at least, the interests of his system in his mind—if he had not, it would not be a system with any life in it. Aristotle's philosophy was magnificently systematic ; and it was vividly alive. Its characteristic habit of life is apparent throughout the *Poetics*. We find there methods and notions that are sometimes more appropriate to Aristotle than to the subject. An invaluable method in biological research is classification. The *Poetics* is full of it. When he is defining his topic, Aristotle's mastery of this difficult method does noble service ; but afterwards, in the exposition of the topic, he sometimes classifies where no classification is needed, sometimes where no classification can be valid, sometimes where any classification must be misleading. We shall pay no attention to all this, since for us it is not his methods, but his results that matter. Again, the ethical notion of " the golden mean," so dear to Aristotle, insinuates itself into the argument in a manner which cannot be so persuasive to us as it evidently was to him.

But often his philosophical habits are most admirable when they seem to appear most casually. Thus, in the very first sentence of the treatise, he completely disposes of the theory of " Art for Art's sake " simply by describing his subject in terms satisfactory to a biological philosopher. " I shall speak," he says, " of the art of poetry and of its various species, discussing the function of each kind, along with the proper structure of a poem and the number and nature of its parts." It would be easy to pass over this sentence as a mere formal introduction ; but every clause of it is important. It posits the whole subject with truly scientific comprehension. To know what poetry really is, we must know not only its anatomy and physiology ; we must know its natural history also. We do not know what an animal truly is, until we have not only dissected it, but also have accurately observed how it behaves. The nature of animal life, the species of the animal, the structure of its body, the number and nature of its organs : we may know all this, but what the animal truly *is* will escape us, unless we also know what it can *do*, how it comports itself, in its natural surroundings. So it is with poetry. Poetry is one of the activities of human nature : but exactly what this activity is we shall never know unless, les analysing it, we note what it effects among the other activities of an nature : unless, that is to say, we note the *function* of poetry. ry must have some function : for, in the world of human activity, ust somehow *behave* : all human activities take place in human re, and must therefore affect each other. Now, if the phrase “ Art for sake ” means that art can never be understood, if we judge it rding to something outside the nature of art, the phrase is a very ary warning. But if it means, as it nearly always does, that art has no tion in life, then the manifest falsity of the phrase is at once shown up ly by formulating what it is we require to know in order to under- l what art truly is. As Aristotle's introductory sentence indicates, etic investigation is exactly analogous with biological investigation. now what poetry *is*, we must not only examine its organism : we must what this organism can *do* in its natural habitat—the lives of an beings. We must know its function. But its function will be itioned by the nature of its structure, and the parts out of which its e structure is made.

istotle begins his investigation by calling poetry a mode of “ imita- ” This was in accordance with the Greek habit of thinking about all e art,” just as it accords with our way of thinking to call art a mode of pression.” As casually as we talk of expression, the Greeks talked of tion ; and neither term is very helpful unless it is defined. We must mber that the Greek word for art never acquired that limitation of ing which our word has in the phrase “ fine art.” For the Greek , activity was either doing things or making things. In doing things, ction itself was to be judged ; in making things, the action was to be ed by what it made—the tangible object which it brought into exist- . It was in the latter case that activity was an art. The value of the art easily judged, when the thing it produced was a shoe or a pot. But if the thing produced was a picture or a poem ? In that case, the value e thing did not consist in its material, nor even in the arrangement of aterial : it consisted in the way the material and its arrangement stood omething. The Greeks said, it consisted in the way the product ted something.

far, the word is completely vague : but it was as imitation that the k mind naturally explained the existence of what we call art (meaning e art ”) ; and Aristotle inevitably made this elementary notion the ng point of his theory. The originality of his theory consists in the tion its argument took from this notion. The easy and obviously ng way to argue from it would be to say that art imitates nature : hen, is the skilled copying or mimicry of the objects we know in the l. This was the popular way of arguing ; and it was also Plato's way. abled him, in conjunction with his *theory of ideas* (which, however, d to strain somewhat for the purpose) to give a plausibly reasoned to his disparagement of poetry—indeed, of art in general. The ation he brought against poetry was as complete as it could be ; the e of poetry, he said, was wholly unworthy of serious attention, the ion of poetry was radically vicious. This latter charge will be ibed later ; at present, we are concerned with his attack on the e of poetry—on poetry, namely, as *imitation*. Aristotle, too, in the early part of his treatise, was no doubt concerned with Plato's attack on the imitative nature of poetry ; and he meets the accusation of consequent unworthiness by giving a completely different interpretation of the whole notion of imitation in poetry. Aristotle's way of interpreting poetic imitation is possibly the most valuable of all his contributions to æsthetic theory. At any rate, it puts the theory on perfectly secure and solid foundations.

All the " fine arts " are connected. It suited the tactics of Plato's attack on the art of poetry to approach it through the art of painting ; for the notion that imitation is mimicry is most easily supported in painting. The attack went thus. The only business worthy of man's mind is his concern with reality. Men should be concerned with *things* for their reality ; and their reality is given to them by the ideas they represent. Now a painter imitates things ; and things represent ideas ; and ideas *are* reality. Painting, therefore, only deals with reality at third hand. Thus, in the famous example, there are many beds in the world ; but beds only exist because the idea of a bed exists. When a carpenter makes a bed, he may be said to copy the one original and universal bed, the ideal bed which (Plato's theory does not shrink from this) was created by God : by which he means, of course, that the ideal is the only truly real. The carpenter's is a necessary and entirely worthy occupation. And now along comes the painter, and copies the bed which the carpenter made : that is to say, he copies the copy of the real bed : an unnecessary and entirely unworthy occupation. And as it is with painters, so it is with poets (Plato, like Aristotle, is thinking chiefly of epic and dramatic poets). The painter copies objects, the poet copies the behaviour of men and women : both artists copy appearances in the world of things, and their work is therefore twice removed from reality.

This abstract does not, of course, do justice to the humour, gusto, good-nature, and persuasiveness with which Plato's inimitable art conducts the argument ; but it may serve to show the strain which the argument puts on the theory of ideas. And yet, if we grant that that theory may include particular objects (and even artifacts, such as beds), and if we grant that imitation in art means mimicry, the logic is sound enough. The attack, at any rate, is not one that can be ignored ; and we must remember that Plato's attack on the nature of poetry prepared the way for a weightier assault on its function. How then is this first assault to be met ? Aristotle, in the *Poetics*, leaves the theory of ideas alone ; for it can do nothing here without the theory that poetry imitates nature, in the sense of mimicry. It will suffice to show that poetry does not imitate nature. And to show this Aristotle does not appeal to *a priori* notions ; he appeals, as a good naturalist will always do, to the facts. He does not do this directly, however ; the facts of the case are implied by the nature of his argument. But they are obvious enough. It may seem easy and inviting theory to say that art is the mirror of nature ; but since we can see nature herself, what do we want with a mirror ? If poetry merely mirrored nature, it could give us no more than nature gives us ; but the fact is, that we enjoy poetry precisely because it gives us something which nature does not give us. We may say, for example, that the persons in dramatic poetry are " like life " ; but where in actual life shall we find such persons—

ns who are interesting in everything they do or say, persons who nually and inevitably reveal both themselves and the events in which live ? The figures of such persons do not imitate nature ; and this is al of poetry in general. What then does poetry imitate ?—But we etter follow Aristotle's argument.

etry, he begins, is a mode of imitation. But instead of saying, as does, that in this respect it is like painting, Aristotle says that it is nusic or dancing. This is significant ; for painting suggests (though falsely) imitation in the sense of mimicry. But the mention of music lancing is a preliminary warning, that whatever imitation in poetry mean, it does not mean mimicry. For what mimicry is there in ? And, though dancing may represent passion and action, its formal ms and deliberate graces certainly do not copy natural gesture and ment. Aristotle then proceeds, by means of a threefold classification, rrow down the general notion of imitation to the particular topics of eatise. He asks, in effect, three questions : In what does the imitation ? What does it imitate ? How does it imitate ? That is, he classifies tion according to its *medium*, its *object*, and its *manner*.

e *medium* of the kind of imitation with which he is concerned is, of e, language. And here he makes a remarkable reflection. He notes he art he is to discuss has, as regards its medium, properly speaking me—no name, at least, comparable for exact and generally agreed ing with such names as " sculpture " or " music." And this is still o-day. For purposes of discussion, we may use the word " poetry " e pure art of literature. But, says Aristotle, people connect the idea etry with a particular kind of rhythm in language. Yet the nature of y is not given by metrical rhythm. Compositions which are designed truct or inform may be written in metre ; but they are not therefore y : in his terminology, they do not *imitate* anything. On the other , compositions may be very successful imitations (to us, " represens " would sound more familiarly) without being written in metre. contrast, then, is not between poetry and prose ; for this simply s a difference in technique ; the true contrast is between literature " imitates " and that which does not ; and *either* of these two classes be written in metrical or in non-metrical language. Thus Aristotle first critic to point out that the essential nature of poetry may often und in prose ; and on the contrary, that verse is no guarantee of y. This short digression indicates that in the sequel his discussion of ticular kind of poetry is a type of the theory of pure literature in al.

ving thus limited his topic to what, for want of a more specific term, ust call pure literature, he goes on to classify this with respect to *ject* of the imitation. In general, he says, the object of poetic imitas *men in action* ; which, remembering his exclusion of lyrical poetry, e found an adequate description. For by *men in action* he does not sarily mean *men doing things* ; he means *things happening in terms of n nature, events embodied in human lives*. In a word, he means a *story*, widest possible sense ; and the essential element in a story is the n element. The objects of poetic imitation, then, may be classified ding to the nature of the human element in them ; and we judge human nature by its goodness or badness. Poetry, then, may represent men as better than in real life, as worse, or as they are. This third variant Aristotle merely mentions, and then ignores ; he is wholly concerned with the other two. The poetry he is to discuss imitates men either as being better than in real life, or as being worse. The purpose of this classification is to derive from one common impulse the two main kinds of non-lyrical poetry, tragic and comic ; and as such it may be provisionally allowed. There is a sense in which a tragic character is better than real life, and a comic character worse. Real people do not exemplify in such capital fashion the qualities which make human nature admirable, nor those which make it ridiculous. Yet this rough sort of classification involves serious difficulties. Tragic characters are not necessarily *morally* better than in real life : witness Macbeth. But if they are said to be better in the sense of being more imposing and remarkable, may not the same thing be said of comic characters also ? Witness Falstaff.

But one thing remains quite unquestionable in this second classification of Aristotle's : poetic imitation does not mean mimicry. How can poetry imitate men as better or as worse than real life ? Obviously, not by copying nature ; but only by imitating imagination. The theoretical possibility that poetry *might* represent men " as they are," Aristotle, we have seen, mentions only to ignore ; no doubt because he did not think it worth discussing. For this possibility is not characteristic of poetry. This is not what we demand of poetry ; and therefore, as a matter of practical fact, this is not what poetry does. We do not want a transcription from nature, since we have the original always before us ; we want an imaginative reconstruction of the possibilities of nature.

Plato took imitation to be the connexion between poetry and nature; which leaves quite unexplained the characteristic quality and energy of poetry (whether in verse or in prose, whether an epic or a novel). Aristotle, with far finer discrimination, saw that the connexion effected by imitation is not between poetry and the world without, but falls wholly within the being of poetry. Poetry is not connected with the outside world in the simple and direct fashion supposed by Plato. The poet first derives an inspiration from the world by the power of his imagination ; the art of poetry then imitates this imaginative inspiration in language. Aristotle's theory is not really concerned with the nature of the originating connexion between poetry and the world, except by certain plain implications in the argument throughout, and for one anomalous digression to be noted presently. His discussion is " concerning the art of poetry." The art exists to give shape and substance to a certain kind of imaginative impulse : the existence of the art implies the existence of the impulse. Aristotle, in discussing the art, assumes the existence of the impulse ; his business is to discuss its nature, and the way it works itself out into language. But to enquire into the connexion between poetry and the world is to enquire into the origin of this impulse ; and the questions how and why it arose belong rather to psychology than to æsthetics. Now it is just possible to imagine life exactly as it is ; but the exciting thing is to imagine life as it might be, and it is then that imagination becomes an impulse capable of inspiring poetry. This is true even in the case of what we call realism in literature ; it is true even when the life imagined was ıally an actuality of some highly exciting nature in itself. Imagina-nay do no more than concentrate the actuality, by dropping out all significant passages. But that will be enough to make the resultant y (or literature) something quite different from that copy of the world ı Plato's condemnation assumed it to be.

us, what Aristotle means by " imitation " in poetry is exactly what ean by *technique*. Poetic imitation, as Aristotle uses the word every- e in his theory (with the exception of an unimportant chapter which forms no part of his theory), does not explain the origin of poetry, vhat the connexion is between poetry and real things and affairs. otle's " imitation " is confined entirely to the poetic activity within rt itself : it describes the connexion between poetic impulse and c language. It is his word for the technique by which the poet finally ves communicable expression of his imaginative inspiration. We say lly achieves " : for, whether the word be " technique " or " imita-" more is involved than the mere management of language, as we soon see.

remains, in the third place, to classify works of literature according eir *manner*. There is no difficulty here. Within the scope Aristotle ssigned to his subject, all poems may be classified either as narrative dramatic. Thus poems which resemble each other in the object may in the manner of imitation, and the other way round. Sophocles as gic poet might be classed with Homer, but as a dramatic poet with ophanes.

means of this three-fold classification, Aristotle has prepared the or the main topic of that portion of his treatise which has survived : ly, the discussion of tragic drama. At this point, however, he (or ps someone else) introduces a chapter on the history and develop- of literature by a brief discussion of the origin of poetry. It treats business in a feeble, perfunctory, and confused fashion, and comes to tional conclusion. That would be no great matter, since, as we have Aristotle's theory is an exposition of the nature of poetry as it actually , and has no concern with the question, How did poetry come to ? What has, however, caused a good deal of misunderstanding, is the hat, in these few sentences, the word for " imitation " is expressly to mean " mimicry." The argument takes us nowhere ; but if it had alidity, it would make the theory in all the rest of the book wholly elligible. Indeed, it would be hard to find plainer contradiction than etween " imitation " everywhere else in the book, and " imitation " s quite superfluous digression (which merely interrupts the process e argument). If we wish to understand Aristotle's theory, there is one thing to be done : this passage must be ignored. We may regard ner as interpolation, or as a queer aberration. But perhaps not an un-ntable aberration. With Aristotle, æsthetic science first begins : it rvellous that it should have begun with a treatment so precise and ate, that in many respects it stands as the last as well as the first on the subject. But very often, when a science first distinctly ges, it uses terms, hitherto in vague and general use, which it has t strictly defined. It is very possible that Aristotle never consciously d " imitation " in the sense which we have been attributing to him.

The word and the idea were there, ready for use in discussion of this sort; and he used them as seemed good to him. But his astonishingly keen critical insight into the nature of poetry led him to make just that specific use of "imitation" in his theory, which is the only intelligible use of the word and the idea in connexion with poetry: which is also, since it enabled him to discriminate between technique and inspiration, a contribution of incalculable value to the theory of literature. And though he does not define it, we are bound to attribute this specific meaning to the word "imitation" in his theory, simply because this is the only thing the word can mean as he uses it. But when he stepped for a moment outside his theory and digressed into the question of psychological origins, a quite different topic, he unconsciously allowed the word to relapse back again into its old meaning.

Coming now to his main subject of tragic poetry, and briefly noting some of the differences consequent on the different manners of epic and dramatic form, Aristotle makes a remark which has had more fame than it deserves. One very obvious difference between epic and drama is, that an epic is much longer than a drama. The reason is simple: a drama must be given complete in a single performance, but an epic is composed under no such necessity. This naturally involves a difference in content; but for Aristotle, with only the practice of Greek drama before him, the difference in content presented itself in a very noticeable way. Drama, he says, tends, "as far as possible," to confine its action to twenty-four hours, whereas epic action need have no limitation in respect of time. This casual remark simply refers to the practice of Greek tragedy, not to anything inherent in the nature of drama. Owing to its peculiar origin and circumstances, Greek tragedy presented its story in an unbroken continuity of action. The sort of story that would best fit in with this mode of dramatic presentation was evidently one that implied no great break in the time, and no great change in the place, of its occurrence. This was a mere matter of practical convenience. But since the tragic chorus might from time to time hold the movement of the story suspended in lyrical comment on it, the dramatist had the opportunity of introducing supposed intervals of time, as well as supposed changes of place, if it suited his story to do so. The Greek tragic poets made no difficulty about occasionally availing themselves of this opportunity. Aristotle himself admits that the rule was not absolute as regards time; about place he says nothing.

Intrinsically, the remark that tragedy "endeavours, as far as possible, to confine itself to the events of twenty-four hours," is of small importance. It is a good instance of the way Aristotle's illustration of his theory was limited by the literature of his time; it is also a good instance of the way he refused to dogmatize on purely accidental qualities. But in the history of criticism, this remark is of immense importance: an importance given to it by the power of sheer misunderstanding. Everyone has heard of the dogma of the Three Unities in drama—unity of action, unity of time, unity of place. Had it not been for this casual remark of Aristotle's, the dogma would never have been formulated. But Aristotle cannot be held responsible for conclusions which merely mistake his meaning. Critics, from the Renaissance onwards, especially in France and Italy,

atically maintained the Three Unities as the great principle of
atic composition, appealing to the example of the Greek tragedians
he authority of Aristotle. Now, for unity of action, which simply
s that a poem must be a single organic whole, Greek tragedy as cer-
provided noble examples, as Aristotle is certainly the best authority,
he it was who first explicitly, and with invincible argument, showed
nity in this sense is the essential thing in tragedy : and that not only
ama, but as the type of all literary composition. But as for the unities
ne and place (which may, of course, in practice be invaluable for
ucing a certain kind of dramatic effect, as we may see in Racine's
dy or Ben Jonson's comedy), the dogma which ascribes any *necessity*
ese is purely arbitrary ; a good instance of those " rules " of criticism
, not being governed by genuinely philosophical theory, are merely
ading. In this case, the rules were governed by nothing but pedan-
and, as it happened, by mistaken pedantry. The supposed example
eek tragedy turns out to be by no means absolute ; and Aristotle,
erly understood, provides no authority whatever. As regards time,
escription of the *necessity* of the so-called unity can be made out
his carefully qualified remark on the practice of Greek drama ; and
gards place, a mere allusion in quite a different context is the only
ge that can be alleged—and must be most fantastically wrested from
ain meaning to give any support to the dogma. No more absurd in-
e was ever done to a critic than the suggestion that Aristotle would
condemned Shakespeare's dramatic treatment of time and place.
akespeare's plays satisfy unity of action, Aristotle would have re-
d no more ; for the theory of poetry requires no more.

stotle now proceeds by focussing everything he has said hitherto
formal definition of tragedy ; which definition his argument then
rates, clause by clause, into a full exposition of the nature and func-
of tragedy. This definition, it is important to observe, is not offered
a priori assertion of what tragedy ought to be ; it is a summary state-
of what Aristotle has noted that tragedy actually is. After giving the
tion, we shall merely give the gist of his exposition of it, without
pting to follow exactly the course of his argument, which is here
tortuous and complicated. This portion of the treatise is the cen-
ctrine of Aristotle's whole theory, and it is important for our pur-
that it should be put as plainly as possible, though his elaborate
ent will doubtless thereby lose some weight.

definition of tragedy, then, is this : Tragedy is the imitation of an
that is serious, complete in itself, and possessing a certain magni-
in language that gives delight appropriate to each portion of the
in the form of drama, not of narrative ; through pity and fear
plishing its *Katharsis* of such emotions.

s is a close paraphrase rather than an exact translation : but
tle's somewhat harsh concision of language defies exact translation
ctively as the finest lyricism of Sappho or Catullus. It will be seen
e definition falls into two divisions. In the first, consisting of the
ree clauses, the *nature* of tragedy is given ; and this corresponds to
reefold classification with which the *Poetics* begins. The nature of
y is defined by that which is imitated—the object ; by that in which

the imitation occurs—the medium; and by the manner—how the imitation occurs. The second division consists of the final clause of the definition, which gives the *function* of tragedy. The crucial word here is the Greek word *Katharsis*. Aristotle, as we have seen, held that, in order truly to understand tragedy, it was as necessary to understand its function as to understand its nature. That function, he now says, is a *Katharsis*; but what *Katharsis* is, he entirely omits to explain. The meaning of the word is ambiguous; it may be either " purgation " or " purification." Which sense does he intend? And exactly what force does he intend the word to have in whichever sense is the right one? For in either case the word is a metaphor. For the present it will be best to leave the word untranslated.

Our first business, then, is to collect Aristotle's idea of the nature of tragedy. We must next try to make out what he meant by *Katharsis* as the term for its function. If we cannot find that he meant anything really satisfactory, we must then try to draw from his idea of the nature of tragedy some idea of its function corresponding with the sort of function Aristotle intended the word *Katharsis* to indicate. We may perhaps find something for which, with a change of the metaphor, the term *Katharsis* may still be used. If so, and if it is a function which genuinely arises out of Aristotle's idea of the nature of tragedy, the whole resulting view of tragedy may properly be called the Aristotelian theory of tragedy: and it must justify itself not merely by offering itself as a theory of Greek tragedy, not merely as a theory of tragedy in general, but as a typical theory of literature.

We therefore now take up, and expand the implications of, Aristotle's definition of tragedy as it is given above. Tragedy is an imitation of an action. By an *action* here is meant an event, or process of events—something happening. But by calling it an *action*, what is also meant is, that this happens by means of, and in the being of, *agents*—agents which have a disposition to act. These agents are, of course, human beings: and their disposition to act is their *character*. The action, then, of which tragedy is an imitation, is a process of events embodied in the lives and wills of human beings. But tragedy is an imitation of an action that is complete in itself, and of a certain magnitude. " Complete in itself," simply means, that the action in itself forms a whole; and " of a certain magnitude " simply means, that it can be *accepted* as a whole—it is neither too small to be appreciable, nor too large to be taken in, as a whole. But to be a whole, it must have a beginning, a middle, and an end. There must be a definite point at which the process of events as such begins, a definite point at which the process as such comes to an end. Before the first point, the process did not exist: it now comes into existence. After the last point, it finishes: the process no longer exists. And in between these two points, the process coherently develops out of its beginning into its end.

Such is the *object* of tragic imitation. And it is at once evident that tragic imitation is not the imitation of nature; for such is not the process of natural events. In nature, nothing at any assignable point begins, and nothing at any assignable point comes to an end: all is perfect continuity. What tragedy imitates is not life, but a conception of life: a very different matter. Some possibility of life is seized on by the poet's mind, and ned as a single movement of events. Some sense of life has become, tense imaginative attention to it, clarified and defined into an idea fe—an idea shaping itself forth in the action of life; and the 1 has the unity of the idea it manifests. The idea, in fact, is what we previously called the inspiration: "action" is Aristotle's technical for imaginative inspiration in the case of drama. And however comhe idea may be, it must be a unity; otherwise it could not be attended n idea. The imaginative form it takes—the action, the movement of s—must be equally a unity: and in that essential respect must be any movement of events in actual life.

gedy is the imitation of this. "Imitation" as we have seen, means, stotle's theory, the technique by which this inspiration is communicexpressed, and the technique is defined by its medium, which is age, and its manner, which is drama: that is to say, tragedy is enacted us by speaking persons, the persons whose behaviour *is* the tragedy. hen we consider what this involves, we see that the language, the dialogue, is only, as it were, the final imitation: actually, there must hole series of imitations before the technique can arrive at the stage guage. This series of imitations can be set out in a scheme of the of their importance, or of their proximity to the originating *action*: ristotle's scheme is only for convenience of discussion; the business hardly occur in this schematic fashion. First, then, the action—that of life which the poet thinks of as some characteristic kind of nent of events—the imagined action expresses itself in the *plot*, or rangement of the incidents. The plot is then expressed in *characters*; *aracters* in their *thoughts and feelings*; and these finally in the diaor *language*. The truth of this scheme is very simply tested: all we to do is to note what happens in us when we witness a tragedy. of course, exactly reverses the order of Aristotle's scheme: an order, nore, which is not meant to represent the process of composition, erely the theory of the art. But in taking in the art, and critically ciating it, we first receive the language; the language gives us the hts and feelings of the persons speaking, by which we understand behaviour; from this we come to perceive their characters, and the cters embody the plot. Doubtless it is impossible to exaggerate the tance of the language; since it is the language which must finally y the whole series of the dramatist's technique. That is why tic language cannot be the speech of actual life, which never has uch burden laid on it: the dialogue of drama must always be ally (it would be correct to say, unnaturally) expressive. But howve look at drama, whether we approach it theoretically, from its e, or critically, from its effect, our conclusion must be the same: y, that the most important thing in its technique is the plot.

stotle asserts this with the greatest possible emphasis. "The plot," s, "is the first principle, and, as it were, the soul of a tragedy: ter comes second." The assertion is strikingly at variance with the ption of many dramatic critics, who regard a dramatist first and ost as a creator of character. But, says Aristotle, character by itself, er skilfully delineated, will never give tragedy: it is only character on that can be tragic (or, more generally, dramatic). Characterization is, in fact, as much a part of the dramatist's expressive technique as the prosody or imagery of his language ; and what he is expressing is the idea of life which inspires him. The assumption that his chief business is to draw character is merely a relic of the naïve and unexamined belief that drama imitates life. It imitates a conception of life ; and characterization is but a phase of this imitation. This conception is what Aristotle calls the action ; and the essence of the action is its unity. It is the plot that expresses the action ; all the rest of the dramatist's technique—character, thought, and language—embodies the plot. It is by means of the plot that, theoretically considered, the whole mass of the drama is held in the unity of the dramatist's inspiration ; and it is by means of the plot that, critically considered, the whole mass of the play falls into a unity of effect.

But the definition of tragedy requires a further limitation. The action it imitates or expresses must not only be a unity ; it must also be serious. " Serious " is hardly an adequate rendering of Aristotle's pregnant epithet ; but what he means is made perfectly clear by his statement that tragedy must arouse the emotions of pity and fear : whereby we pass from his definition of its nature to that of its function. We must remind ourselves here of Aristotle's implied opposition to Plato. For it was against the function of tragedy, and precisely against its function as rousing pity and fear, that Plato brought his gravest charge. We have already seen how the Aristotelian doctrine of imitation gives a complete answer to Plato's accusation, that poetry is an unnecessary, superfluous, and unworthy form of activity. The whole force of the accusation there is derived from a misunderstanding of the imitativeness of poetry, and vanishes as soon as the true nature of poetic imitation is shown. So far, Aristotle's account of tragedy, by bringing out the full import of his doctrine of imitation, has made his case against Plato in this respect unanswerable. For no one can deny that to define tragedy as the imitation of an action in Aristotle's sense, with all that Aristotle finds implied in that definition, is simply to describe, with unmistakable accuracy, the nature of tragedy as it actually exists. But Plato also charged poetry, and notably tragedy, with having a radically vicious effect, due to its power of exciting emotion ; and this much more considerable charge Aristotle opposes by his doctrine of *Katharsis*. All the rest of his treatise is governed by the doctrine : whatever else he has to say about tragedy involves its *function*—which indeed could not but be of the first importance to a philosopher of Aristotle's outlook and predilection. Unfortunately, the idea of *Katharsis* was so familiar to him, and doubtless to his pupils, that he never stops to explain it. Even more than was the case with " imitation," we must make out what the word means by the way he uses it.

But first we must understand what Plato's charge against tragedy was. Roughly, it is this. How does a tragic hero arouse our emotions ? By bewailing his misfortunes : the more he can make us feel his grief, the more we admire him. Now in real life, the man we admire, and rightly, is the man who, without complaining, endures misfortune and controls its effect on him. Who would not be ashamed to indulge his lamentation, and to press his affliction on his neighbours ? Can it be right to admire an actor for doing the very things we despise in real life ? Moreover, by giving way to sympathy with him, we enjoy these lamentable emotions ; sorrow nes facile ; pity, by weakening our control over grievous feelings, rages us to indulge them also in the case of our own misfortunes. vhole effect of tragedy tends to debility of spirit : reason relaxes its on conduct, emotion takes charge.

stotle does not attempt to challenge (as he did in the case of the iveness of tragedy) the facts on which Plato grounds his accusation He agrees that it is characteristic of tragedy to arouse emotions , in themselves, are dangerous, and perhaps unwholesome. Indeed, clearly wrong in agreeing too closely with Plato in this respect ; for h pity and fear are certainly important among the tragic emotions, re not the only tragic emotions : love and admiration are equally tant in the effect of tragedy. But of the emotions he names, everyone admit that fear is not an emotion to be encouraged for its own sake ; robably Aristotle had the same opinion of pity : at any rate, excess of ike excess of anything else, he would regard with strong disfavour. ays Aristotle, tragedy not only rouses these emotions ; it also, by the rouses them, effects a *Katharsis* of them. This is his answer to Plato. *harsis* is in any case a metaphor. It may allude to rites of religion, ich case it means " purification " ; or it may allude to theories of ine, in which case it means " purgation." It is not easy to see exactly s meant by " purifying " pity and fear ; though something vaguely gous with this sense may commend itself more plausibly as the sort of on Aristotle had in his mind, than that on which he actually d. For it seems certain that " purification " was not what he himself by *Katharsis*. Whenever he alludes to the tragic *Katharsis*, this is ntly identical with the mere fact of rousing pity and fear. There is any hint of a " purification " of these emotions. But if he meant gation," it would be quite enough to refer to *Katharsis* as the mere g of these emotions. In Greek medicine, an organism could be d of any undesirable product by the administration, in judicious of something similar : as in modern homeopathy, " like cures like." s of any kind was unwholesome ; health could be secured by purga- f anything which tended to be present in excess. This seems to be Aristotle meant by *Katharsis*. Tragedy effected the purgation of nd fear, by its administration of these very emotions : it was desir- hat these emotions should be discharged, either because they were olesome in themselves, or because they tended to excess. Confirma- f this is given by what Aristotle says elsewhere of the effect of music. n highly exciting kinds of music have, he asserts, the effect of calm- hose who are already in a state of high excitement : by the istration of like emotion, their excessive emotion is purged away, e process, he notes, is accompanied by feelings of pleasure. That as Aristotle's own interpretation of the doctrine of *Katharsis* was nderstood by Milton, who seems to have been the first English to explain it precisely. In the preface to *Samson Agonistes*, Milton ragedy the " most profitable of all other poems " ; and supports pinion by invoking the authority of Aristotle in these terms : efore said by Aristotle to be of power by raising pity and fear, or to purge the mind of those and such like passions, that is to temper duce them to just measure with a kind of delight, stirred up by reading or seeing those passions well imitated. Nor is Nature wanting in her own effects to make good his assertion : for so in Physic things of melancholic hue and quality are used against melancholy, sour against sour, salt to remove salt humours." Here we touch the medieval version of Greek medical theory. But there can be no doubt that Milton was entirely right : Aristotle regarded the function of tragedy as something medical : the pity and fear of tragedy were the doses by which the tragic poet homeopathically purged his audience into emotional health.

The medical analogy, of course, means nothing to us, except as a curiosity. But it is not for that reason that the theory fails ; there might be something in it, which would stand, without any analogy to support it. The theory, however, is unsound in itself. What Aristotle says of music may be true ; but in that case, the persons who were cured by ecstatic music were already possessed by ecstasy. But an audience does not go into a theatre in a state of pity and fear. Everyone is liable to these emotions ; but they are not present unless they are provoked. Tragedy, in order to be curative, must first produce the disease it is to cure. Yet we must surely feel that Aristotle's explanation of the function of tragedy was an attempt in the right direction. Tragedy certainly does produce an enjoyable and wholesome effect, by rousing in us emotions which in real life would be unpleasantly and perhaps dangerously disturbing (though these are not the only emotions it rouses). And the earlier part of Aristotle's theory—that which expounds the nature of tragedy—will give us a sufficient explanation of this remarkable effect : which, for the sake of convenience, we may still call *Katharsis*, though not now in the medical sense, and not exactly in the religious sense of " purification." But in so far as the emotions roused by the spectacle of the evil in life—not merely moral evil, but the evil of destruction and waste and misfortune—are by tragedy deprived of evil effect, and even made beneficial, something like " purification " may be alleged.

We return to that quality which Aristotle showed to be essential in the nature of tragedy—its *unity*. It is from this quality that he deduces his famous assertion, that " poetry is a more philosophical and a nobler thing than history." That is to say, poetry is more in accordance with the spirit of philosophy, the instinctive desire to *understand* : which means, the desire to know the laws of things, and to generalize these laws as widely as possible—to proceed from knowing how one thing is connected with another, to knowing how all things are connected together. Now history relates what has actually happened : things happened just so, but *why* they happened just so we can never be sure, for we can never account for all the antecedents of an actual event, nor reckon up all its consequences. We can surmise the law of the event, but we can never know it. But poetry relates what may happen according to the law of probability or necessity. We know what happens and we know how it happens. In contrast with history, in which nothing begins and nothing ends, and in which the mere sequence of events must satisfy as best it may our desire to know the secret connexion of events, in poetry we see an event complete in itself, definitely beginning and definitely ending, and proceeding with perfect coherence from antecedents we understand to consequences we accept as inevitable. While we live in the event, e in the world we most profoundly desire ; our consciousness of takes the form of a world in which all things are connected to- r.

w tragedy exhibits the misfortune of life. But by reason of the of tragic drama, even the misfortune of life becomes an instance world we most profoundly desire. This accounts for the peculiar re we take in tragedy. Things which in real life would be merely ssing become in tragedy nobly exhilarating. They do not cease to stressing ; but something is added to this ; whereby their evil es our good. Even in evil, we gain the world we need. And in this tragedy may be said to effect a *Katharsis* of the emotions it rouses. ot the *Katharsis* Aristotle meant ; but it is entirely in accordance vhat Aristotle says. It is also in accordance with the facts.

the rest of the *Poetics* is governed by Aristotle's idea of *Katharsis* function of tragedy. Wherever the idea is valid, our interpretation ill be found workable : which is not surprising, since it is an inter- ion Aristotle himself might well have given. But his insistence on nd fear leads him sometimes to emphasize sensationalism in y, and sometimes serves to excuse the prejudices of his philoso- system. A celebrated example of the latter is his account of the r heroine proper to tragedy. A tragic character is one that passes prosperity to adversity. This must not be, says Aristotle, because villain : that would arouse neither pity nor fear. But it must not e unmerited misfortune of a perfectly virtuous character : that be merely shocking. The tragic character must be something in en these two extremes : a person who is good, but not eminently and who brings on himself misfortune by his own error. This is Aristotle's doctrine of the " golden mean " intruding where it business. " The practise of the stage," he says, " bears us out." no such thing in his day, and has never done any such thing since. haracter Aristotle describes may certainly be a tragic character ; ually tragic may be an utter villain, like Macbeth, who deserves all isfortune, or a perfectly innocent person, like Desdemona, who es none of it.

so great is Aristotle's prestige, that critics in all succeeding ages ttempted to reduce the practice of the dramatists to his theory of character. Thus, it is pointed out that in the tragedy of *Prometheus* , Æschylus has drawn a noble hero who nevertheless has grave This is quite true ; but the whole point of the tragedy—the thing akes it perhaps the greatest of all tragedies—is that Prometheus ot suffer for his faults, but for his virtues : it is because of the good done that the Power which rules the world condemns him. Of , any act that goes wrong may be called an error ; but this is not Aristotle means. For him, the tragic error (which he at one point ust be a *great* error) is quite plainly a moral lapse, not a mere to calculate all possible consequences. The truth is, that he d, in the interests of his theory, the unmistakably tragic effect of nce suffering undeservedly, of Right punished by Wrong—and ed for *being* Right. If his theory of tragic function had taken into t its rousing of love and admiration as well as of pity and fear, he would scarcely have failed to perceive the tragic possibilities in the suffering of innocence. Perhaps also he would have done justice to the other case which he denies to be tragedy—the opposite case of the downfall of the heroic villain. For, as *Macbeth* shows us, it is possible to admire a villain ; possible even to feel for him a sympathy which is not, in the end, very far from love.

But much more interesting than attempts to apply Aristotle's rule to cases which obviously contradict it, is the modification of it which Hegel suggested as the true doctrine of the tragic person : though here again æsthetic theory doubtless recommended itself to its author for its convenient accordance with his general philosophy. Certainly, says Hegel, the nature of tragedy allows a character to suffer for being in the right ; and yet the suffering may be just. For the right may not be an absolute right. It may be valid in ordinary circumstances ; but there may also be circumstances in which it is irreconcilably opposed by another equally valid right. Both are right ; but each is right only from its own point of view. The stock instance is Sophocles's tragedy of *Antigone*. Antigone's brother has committed the worst possible crime against his country, and has been killed in the act. Kleon, the ruler of Thebes, has refused him the rites of burial ; thus answering one atrocious wrong by another equally atrocious. Antigone contrives to pay the rites demanded by religion to her brother's corpse ; and is punished, as she knew she would be, by death. She appeals to the " unwritten laws " which man's conscience must obey against all earthly laws ; but Kleon appeals to the laws which the State has a right to make in vindication of its existence. Now, says Hegel, Antigone is in the right ; but only from her point of view ; she represents the rights of individual conscience. But Kleon is equally right from his point of view ; he represents the rights of the State. The conflict is irreconcilable. Both must suffer ; that is the tragedy.

This, like Aristotle's theory, is one of the possible cases of tragedy : but it no more provides a universal rule than Aristotle does. The *Antigone* itself does not bear it out ; though Hegel's theory certainly reminds us that, in order to understand Sophocles's tragedy, we must sympathize with Kleon as well as with Antigone. But the tragedy is, nevertheless, that Antigone is right and Kleon is wrong : and that the wrong has power to condemn the right. However plausible, and indeed profound, Hegel's theory may be, perhaps there is no tragedy that exactly accords with it. But the whole age-long discussion is a good instance of how criticism may be misled by a theory which, however philosophical elsewhere, is not truly philosophical in *art* : theory, that is to say, which, professing to interpret the facts, only does so by presenting facts which it can interpret.

With the rest of Aristotle's treatise we need not further concern ourselves ; though it is all eminently worth the carefullest study. But we now have the main features of his theory of tragedy : which, once more, is to be understood as a type of the theory of literary art in general. He illustrates it by working it out in detail in many interesting and important directions ; and he shows how it can be transposed from the dramatic to the narrative manner—from tragedy to epic. It is enough for our purpose to have explained the general nature of his poetic theory. For, whatever oe said against it here and there, Aristotle's theory of tragedy is the lation on which all subsequent discussion of literary æsthetic has securely based itself.

IV. AFTER ARISTOTLE

attempt will be made in this section to sketch, however cursorily, ing like a connected history of literary criticism since Aristotle. if we confined ourselves to English literature, it would not be ole here to describe the criticism of all those authors who have ved marked eminence in this kind of writing. Nor, indeed, would ve our purpose. The criticism of literature is often as entirely idual as the creation of literature, and as much the work of indefin- genius. Its success may be due to talents which do not require, and nly do not seek—which perhaps would indignantly repel—the ort of philosophical principles. Insight, sympathy, imaginative re- e, common sense, or mere power to express discriminating gusto— ese abilities, and other such, may excellent criticism be made, ut anything being formulated. We may call this intuitive criticism. concern, however, will be with the criticism which is notable not y for its quality, but for its addition to, or confirmation of, the gible *methods* of criticism. We shall attempt no more than a sum- account of several tendencies in the history of criticism, briefly ng some important contributions to its rational tradition. This s that we shall be concerned with critics who have been at least that there is such a thing as literary theory, even though they may ave been inclined to formulate it; similarly, we shall only mention ists whose doctrines have proved, in one way or another, of value ticism.

race is typical of the critic who has a *method*, which he is prepared out in a more or less systematic body of rules, independent of cases of the critical estimation of literature. Such a method ntly supposes a theory underlying it; but Horace is also typical critic who does not trouble to expound his theory; he is quite nt if the rules themselves provide reasonable guidance. The theory lying the *Ars Poetica*[1] is substantially Aristotle's; but Horace's st in it is not in the least philosophical, but purely practical; he s it for what he, as a critic, can make of it. Thus the poem is in no an argument; it is a collection of precepts and pieces of advice, vhat abruptly put together, and always with a connexion that is more al than logical. For it must be remembered that the *Ars Poetica* is imarily a work of criticism; first and foremost it is a poem—a poem subject of criticism. And the chief value of its subject is in the it urges Horace to write. There is more to be learnt from its nanship than from its precepts. Perhaps no poem of comparable has provided so many phrases that have become the common ty of international culture. Here is the "purple patch"; here ner nods"; here the critic exclaims "*incredulus odi*"; and here the old man is "*laudator temporis acti*." The context of that last phrase is a good instance of the way Horace treats his subject. A character, he says, must accord with what we know of life; it must, for instance, be suited to the supposed age of the person represented. And at once he proceeds to a brilliant summary of the changes in human nature with the process of time; finally arriving at his pregnant, pathetic, and cruel picture of old age. He has forgotten all about literary criticism. It is the poet who knows the world, and who can distil his knowledge into a quintessence of language, that is writing now.

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[1] ood prose translation by Fairclough in the Loeb Library (Heinemann), lively metrical version by Conington (Bell).

But these memorable phrases are not always, in relation to his discussion of criticism, merely ornamental. Their real point is sometimes lost when they are removed, not so much from their logical, as from their poetical context. When an author seizes on an opportunity for fine writing, we talk of a "purple patch." But that is not quite what Horace meant. He disapproved of the "purple patch" that was "*sewn on*": that was not, therefore, an integral part of the texture of the whole. And this is typical of his critical method. Throughout the *Ars Poetica*, the governing consideration is the essential doctrine of Aristotle's *Poetics*, the doctrine of Unity. And it is the genuine Unity which Horace maintains: Unity of action, as it came to be called; Unity of substance, of mood, of effect, as Horace maintains it. This is the chief debt which the tradition of criticism owes to the *Ars Poetica*: it was Horace who made the spirit of Aristotle's theory the ideal of European criticism. Horace was read when Aristotle was not; even when Aristotle's influence in Europe was at its height, Horace was infinitely more readable than Aristotle; his witty epigrams, deliciously phrased, disseminated the doctrine as Aristotle's compact and elliptical reasoning never could have done. It was Horace, in fact, who made men feel that the demand for Unity in a work of art is identical with *good taste*; and this was not recommending a certain fashion in taste; it was simply making men conscious of what good taste really is. A sound philosophy of art is nothing but a rational account of good taste. Horace, by transforming Aristotle's doctrine into critical rules, philosophically enlightened good taste without troubling his readers to philosophize about it. His immense influence in the history of criticism is, indeed, precisely due to the fact that he made æsthetic theory *appeal* to good taste.

Except in one important particular, he has nothing of his own to add to the *Poetics*. He is, in fact, a thoroughly conservative critic: it may be counted against him, that he is chiefly responsible for the wholly false notion, that classicism means conservatism. But his conservatism is easily explicable. The example of the Greek poets, he says, must be studied night and day. Poetry must still be composed as they composed it. For instance, the characters they gave to the great figures of myth and legend must be exactly maintained. Horace thinks that this respect for the ancients leaves quite sufficient room for originality; and he apparently forgets the extraordinary liberties the Greek dramatists allowed themselves to take with the psychology of their heroes. But it is not easy for us to realize how completely Roman culture in Horace's day was dominated by Greek models and Greek standards. The very idea of literature might almost be said to be a Greek idea transported to Rome;

inly that could be said of literature as an activity cultivated for its
sake—of literature, so to speak, conscious of itself as an art. There
for Horace, only one safe way in literature : and that was the Greek
This is simply the historical situation of Roman culture translated
opinion. When we find, in a totally different situation, Pope recom-
ding a similar respect for the ancients, the grounds for this respect
completely changed. Pope has to give plausible reasons for it.
ce is aware of no such necessity. For him, if literature is to exist
, it must be on the Greek model : the reason why Greek standards
be accepted in literature is identical with the reason why there is
a thing as literature. And that, being a philosophical question, is no
ern of his. He simply assumes (quite rightly) that the doctrine he
unds contains the answer.

t Horace had another and more salutary excuse for his conservatism.
Ars Poetica is, in form, a body of precepts addressed to those who
to compose poetry. He detested the notion that poetry is something
ntric ; though Aristotle himself is partially responsible for the belief
poetry and madness are allied, Horace abhorred the poets whose
piration " took the form of crazy behaviour either in their art or in
conduct. The rage for extreme individualism provoked in him his
liest conservatism ; and his determined assertion that a poet must
rational being, and poetry a rational art, is not the least of his services
und criticism. Thus, under the appearance of advising poets how
iticize their own compositions, his real intention is to declare the
nature of literary merit ; and his rules and precepts for self-criticism
me applicable to the criticism of literature in general.

t in one matter, Horace is remarkably liberal : and that he is so in
particular matter is an excellent instance of his sanity as a critic.
is the matter of diction. Aristotle's treatment of this is very dis-
inting. But Horace's is exactly right ; and unfortunately it is just
that his wisdom has, in the history of criticism, been least influential :
gh nowadays it is just here that it might seem most valuable. Poetic
on, he says, can never be an altogether established and stationary
r. The function of language in poetry is to express ; but man's
rience, which poetry exists to express, is continually changing,
it is continually adding to itself. With the growth of experience,
anguage of poetry must keep pace, if it is to be truly expressive.
guage is like a tree ; and its words are like the leaves. As the years
n, the old leaves fall, and new leaves take their place : but the tree
ins the same. Horace's simile nicely puts the case of language and
ords in the art of literature. But we must remember that in the trees
h Horace had in mind, all the old leaves do not fall off at once ;
at any moment, the leafage consists of both old and new. So it must
ith poetic language. New words must be continually coming in, and
vords dropping out. The poet must not expect to rely wholly on the
ed poetic vocabulary of his predecessors, and he must not be afraid
eing the first to make poetic use of new words. But of course, as
ce admirably points out, there is always the possibility, by skilfully
ng words together in phrases, of making quite new poetic use of the
familiar words. Much fallacious writing and thinking about poetic

diction would have been saved, if this exquisite passage, which is as true to the nature of language as it is to the nature of poetry, had had on subsequent criticism anything like the influence of his doctrine that Five Acts in Drama are prescribed by an absolute rule.

On the whole, if we judge by effect, the most important name in the history of criticism next to Aristotle is Horace. Criticism which can give a rational account of itself was first made possible by Aristotle's philosophy; but it was the *Ars Poetica* which broadcast the seed of the *Poetics* over every literature in Europe. In the *Poetics*, the efficacy of Aristotle's doctrine depends on his readers' ability to follow philosophical reasoning; in the *Ars Poetica*, the magic of poetry has released it from this severe condition: henceforth the doctrine, or the essential spirit of it, is something which can *be enjoyed.* And the whole world has enjoyed it. What the history of Criticism owes to Horace is quite inestimable. Of no other figure, in the rest of our summary, will it be necessary to speak so fully.

In the scale which our survey requires, after Horace the next great figure in the critical succession is *Dante.*[1] For Dante, Aristotle was "the master of those who know"; but this was not the Aristotle who wrote the *Poetics*. Dante knew no such Aristotle. He knew Horace; but his philosophical mind required more than the *Ars Poetica* could give him. Possessed by the merciless rationalism of the middle ages, no rules could be valid for him without the theory on which they were grounded. But his theory was mainly theological, and is to-day not much more than an intellectual curiosity. Yet he can startle us with such complete anticipations, precisely argued, of modern theory, as his division of the power of language into "*signum rationale*" and "*signum sensuale*"; which is exactly our quite recent distinction of "semantic" and "phonetic." And his division is reasoned from profound insight into the nature of language. No doubt his chief contribution to criticism, though its importance is only historical, is his defence of a national vernacular in literature against the specious claims of the universal language of learning, Latin. His account, in the unfinished *De Vulgari Eloquentia*, of the structure of vernacular lyrical forms, is of great value to literary history. But his attempt to found a noble vernacular diction on an æsthetic classification of words is nothing; it was the poet in him, not the theorist, who made Italian a match for the language of Homer or Virgil. Much more interesting, and vastly more important, is his assertion, elaborated in the unfinished *Convivio*, and succinctly given in the letter to Can Grande della Scala, of the symbolic meaning of poetry. This is an invaluable supplement to Aristotle's theory. For Dante, the "action" or story, which inspires a poem, means more to the poet than its merely human events; it has seized on his mind because it seems to symbolize for him some conviction or intuition of the inmost meaning of life. According to Aristotle, the art of a poem is the symbol (or "imitation") of its inspiration—its "action"; and now, according to Dante, the action is itself symbolic. So that the whole poem not only embodies the action in artistic shape and substance, but by so doing suggests the symbolic (or, as Dante calls it, in a broad use of the word, the "allegorical") significance of the action.

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[1] The works mentioned are translated in the Temple Classics edition (Dent).

may not be a universal rule ; but its enlargement of Aristotle's sys-
of " imitations " is clearly required in order to account for the full
t of such poems as the *Æneid* and *Paradise Lost* and *Gerusalemme*
rata, as well as of Dante's own *Divine Comedy*. The symbolic nature
uman events as the inspiration of poetry is even more evident in
al poetry. The emotional moment which a lyric celebrates may to the
mean much more than itself ; and if it is completely caught in lan-
e, it will suggest this to the reader also. Dante himself is the great ex-
lar here : his love for Beatrice meant immeasurably more to him
merely human passion ; it was a symbol of matters transcending
ality. What these matters were, Dante endeavoured to expound,
ely in terms of the scholastic philosophy. But they cannot be ex-
nded : only the sense of them can be conveyed when the art of poetry
pable of conveying the very life of the moment that inspired it. Thus,
he higher criticism of certain noble kinds of literature, Dante's doc-
of the " allegorical " nature of poetry is indispensable. There are
y novels in which the action is as symbolical as the *Æneid* itself of
ers not otherwise expressible.

uch of the criticism of the Renaissance was deeply concerned with
Poetics. The main contribution of the Renaissance to the history of
cism was, in fact, the recovery of Aristotle's æsthetic philosophy for
modern world : though, as we have seen, the spirit of that philosophy
long been effective in the generalized form of the rules and precepts
orace's *Ars Poetica*. In the earlier stage of the Renaissance, indeed,
ace was still the sole authority ; a position from which only Aristotle
d depose him. But that followed inevitably on the discovery and cir-
tion of the *Poetics*. Renaissance criticism, however, added little of any
e to Aristotle ; its chief business was to interpret him. But there was
direction in which Aristotle's theory could obviously be extended.
o said poetry imitated Nature. No, said Aristotle ; it imitates a con-
ion of Nature : and to that he confined his theory. But what is the re-
n between Nature as it is and Nature as the poet conceives it ? What
the poetical conception of Nature mean ? The answer is no doubt im-
d by Aristotle's theory ; but the Renaissance critics began to make it
icit. Thus Sir Philip Sidney, in his brilliant *Apologie*, insisting on the
dom of poetry, finds its proper business in its creation of a sort of
terpart to Nature, in which whatever may delight us exists in its per-
on ; and Bacon more profoundly says that poetry " doth raise and
the mind, by submitting the shows of things to the desires of the
d." Since the Renaissance, this is the direction in which what we may
Aristotelian æsthetic theory has tended to develop. With Kant, the
nian " desires of the mind " became the desire for a representation
e purpose in things ; but poetry, he says, represents things as pur-
ve without representing any distinct purpose. So, too, for Shelley,
ry has a moral effect, without recommending any specific morality.
morality is simply mental life at its highest and finest ; and the vitality
e mind is in its imagination, which poetry feeds. In poetry, we live
e world out of which our sense of the purpose of things and the
lity of action emerges : we live in the world which is immediately
n its own account, without reference to ulterior standards, significant.

In what region of experience can this immediately satisfactory world occur ? Benedetto Croce gives the answer : it is in the region of pure intuition, of experience accepted for its own sake. The question of the *reality* of experience does not arise in this region : we are satisfied with the experience itself, simply as such. But Croce seems to limit his answer to sensuous and emotional intuition. Yet anything at all, even ratiocination, can be intuited and taken as pure experience. The conception of nature, then, which poetry represents (and poetry stands for the art of literature generally), is a conception of the world which we most profoundly desire, imagined simply as existing, and satisfying our desires simply by being so imagined. And what we most profoundly desire in the world is law and order. Any kind of pure literature is inspired by the conception of a world which merely has to exist in order to assure us that its existence is an affair of perfect interconnexion and coherence. This is true, however the inspiration is represented to imagination ; whether as short story, or novel, or drama, or epic, or lyric.

This is the more theoretical tendency in criticism. But also since the Renaissance another tendency, of at least equal importance, has been discernible—the criticism of literary style. The fountain-head of stylistic criticism is also a Greek treatise, usually called *Longinus on the Sublime*[1] : a work which has sometimes seemed to rival in importance even the *Poetics*. But it is a wholly critical work, making no appeal to any philosophical theory of art. Though the work of a Greek of the first century, its importance in the history of criticism is entirely modern, dating from 1554, when it was first printed ; it seems to have been unknown to ancient or medieval culture. The title is a double misnomer : it is not by Longinus, and it is not concerned, in our sense of the word, with the Sublime. The anonymous author was attempting to formulate the nature and constitution of that style in literature which " elevates " language above its ordinary uses. He was the first comparative critic of literature ; for besides Greek and Roman, he could also draw from Hebrew literature, quoting with admiration from Moses (" no ordinary man "), as a sentence worthy of the Deity, " Let there be light, and there was light." The great merit of his treatment of literary style is, that though he certainly regards it as a quality on which criticism may fix its attention, he never thinks of it as a mere outer layer of decoration. Style, for " Longinus " (so, for convenience, we may continue to call the author), is the revelation of the very spirit of a work and of the personality of its author. The saying " Style is the man " takes its origin from " Longinus " : but he is too good a critic to leave it at that. Style is the man indeed : but the man doing a particular piece of work in a particular kind of mood. He attempts to classify the various causes in the nature of both work and poet, which can produce " elevated " style : the scheme is perhaps not quite satisfactory, but very suggestive. He thinks these " sources of elevation " (grandeur of conception, vehement passion, the ability rightly to employ certain definable modes of linguistic expression) should yield rules for good style : rules of such genuine authority that the breaking of them could be counted positive and unmistakable faults. Nothing should condone such faults ; for they are the true sins against good taste, offences against the

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[1] Translated by Rhys Roberts (Cambridge University Press).

t harmony of poetry. But he admits that genius is not to be bound by
; though the admission does not compromise the validity of his rules.
ts are none the less faults for being committed by genius. But the
strong energy of genius, which ignores rules and commits faults, is
likely to do valuable things in the whole result, than the cautious
which always remembers the rules, and will run no risk of offending
taste. Yet no poet, who wishes to make the most of his endowment,
ld be indifferent to rules—at any rate, to " art " in the sense of
onscious and rational management of his creative power. There are
who say poetic power is simply the gift of nature. It undoubtedly
gift of nature, like good fortune. But just as, in order to use good
ne, good counsel is advisable, so the poet will be wise if he allows art
ow him how best to use what nature has given him.

the criticism which we may call stylistic (taking style in the large
which " Longinus " had given it), this attitude to poetry first be-
s effective in English literature with Ben Jonson. Against the
al Elizabethan reliance on spontaneous, and often ungoverned,
y, Jonson upheld, by magnificent practice and vigorous precept, the
of poetry as creative power controlled by conscious, deliberate, and
ed art : in which, however, abstract rules (the Unities of Time and
, for instance, or the Five Acts in Drama) were only valid as they
d a genuinely rational artistic purpose. When Elizabethan spon-
ty failed, " strangled in its waste fertility," Jonson's was the ideal
survived into the succeeding ages ; and the " school of Ben " was
rfully confirmed in its general attitude by the criticism, vacillating
inciple but always rational in method, of Dryden. But it was *Pope*
first in English literature attempted anything like a complete ex-
ion of stylistic criticism. Like Horace's *Ars Poetica*, *An Essay on
cism* is first and foremost a poem, and as poetry is primarily to be
ed : and a most delightfully entertaining poem it is, as full as any-
Pope ever did of his memorable wit and his exquisite skill with
s. But it is a poem on the subject of criticism ; and of great import-
in the history of that subject for its bringing together into one focus
nfluences of Aristotle, " Longinus," the school of Ben Jonson, Dry-
common sense, French ideals of literary taste, and the rationalism
artesian philosophy. Whence does criticism derive its authority ?
combines into a single mental attitude three authoritative ideas—
dea of Nature, the idea of Antiquity, the idea of Reason. All three
be obeyed ; but this means no divided allegiance—rather the
rity of each one confirms the other two. " First follow Nature " ;
learn how to do this, study the Ancients. For the Ancients were at
vith Nature ; Nature and the Poetry of Antiquity are the same. But
study the Ancients is to study art that always accords with reason :
sson of antiquity is that poetry must obey the rules which reason
ribes. How is this ? The answer is (and here comes in the influence
t rationalism which the immensely potent philosophy of Descartes
nade almost universal), Nature herself is reason. If nature seems ir-
al, it is our own understanding that is at fault. The ancient poets
ayed a rational world, because they knew what nature truly is. The
of art which they obeyed were not imposed on nature ; the rules

were drawn from nature—they were " discovered, not devised," they were the laws which nature " first herself ordain'd " : they were the very truth of nature, precisely because they were rational. If there is any distinction to be drawn between art and nature, it is that art, being rational, is more natural than nature herself—than the nature, that is, of actual experience.

This dogma (for of course it is nothing more) that nature is really identical with reason, and that consequently nature is never so natural as in art (if art obeys the ancient rules), is the keystone in Pope's theory : a theory which may be described as a lucid confusion of ideas. He did not revere the Ancients, as Horace did, simply because they were predecessors, who could provide instructive instances of successful poetic art ; he revered them because, somehow, they possessed nature's secret. Aristotle had given a rational account of their art ; and therefore their practice must be rational. This is no doubt true, though very far from the whole truth. But Pope's theory does not amount to more than this : that the nature which poetry draws is the nature which we *desire* to know. This gives us no more than Aristotle had given. But Pope is writing in favour of a certain style of poetic composition—not only in language, but in conception also. It is what we roughly call the eighteenth century style of poetry ; and since the theory of it could invoke three names of such authority as Nature, Antiquity, and Reason, it is no wonder that this style could outlast a whole century—that it could begin in the seventeenth, prevail in the eighteenth, and continue well into the nineteenth century.

But Pope, the editor of Shakespeare, could not but admit that there might be " glorious offenders " against the rules. This admission is quite different from the apparently similar admission made by " Longinus." With " Longinus," faults were faults, whoever committed them. But with Pope, the rules were such, that an offence against them might be an excellence for which the rules had not provided. For the rules can only give as much as we can perceive of nature's reasonableness ; and genius may always transcend our ordinary perception of this. The admission that genius is *right* not to be limited by the rules should, properly speaking, deprive the rules of all their supposed validity. They cannot, at least, be more than provisionally valid.

Eighteenth century poetic style is most conspicuous in its diction. If poetry is always a rational art, must not the same kind of diction be always its most suitable medium ? Thus there came to prevail the belief that a certain kind of diction was, *per se*, poetical, and would be right for all poetical occasions : and the formation of a diction that seemed to satisfy these requirements was perhaps the most remarkable achievement of the eighteenth century. But in fact it was only really suited to a peculiar kind of rational inspiration. Revolt against it had been frequent, though sporadic, during the eighteenth century itself, and in 1800 its universal pretensions were exploded by Wordsworth's celebrated Preface to *Lyrical Ballads*. Wordsworth denied that there can be any such thing as diction poetical *per se* ; the proper language for poetry is the " language really used by men," which becomes poetical by the way it is used. Like most reforms, this goes too far in the opposite direction ; and Wordsworth himself in his practice never hesitated, when it suited his purpose, to use ıge which belongs to literature rather than to life. But his protest re- invaluable ; after Wordsworth, the tradition of criticism approves se of any language in literature which will serve the writer's turn. rly speaking, there is only one fault to be found with style : failure expressive in the sense of being truly, finely, and vividly communi- . Wordsworth cleared the way for the Romantics and all subsequent nents towards liberty of style. But the lesson of the eighteenth cen- ıas not therefore been lost : the tradition of criticism still bears the ss of its tremendous emphasis on the ideal of " Longinus " and Ben n. Whether nature is rational or not, poetry must be : not necessarily lly or scientifically, but artistically, rational. It must be an activity is wholly and completely *designed*.

ntion of the Romantics brings us to the third main tendency in the ion of criticism ; though, like Romanticism itself, it begins long be- ıything like a Romantic Movement is discernible. This too may be the influence of Descartes : at any rate, it belongs to something wider than literature and its criticism. It forms part of the increas- ıportance in modern consciousness of the distinction between the tive and the objective elements of experience, between the person xperiences and the world that is experienced, between " inner " outer " life. This tendency may be most suitably approached, per- through its addition of a new category to critical valuation. This is tegory of the Sublime, in the sense in which Coleridge uses the when he claims Sublimity to be the peculiar distinction of Hebrew ure as against Greek or Roman. The suggestion is that sublimity is ıow superior to mere beauty.

e category of the Sublime first decisively enters the critical tradi- vith Burke's *A philosophical inquiry into the origin of our ideas of the ne and Beautiful* (1756). Neither the theoretical nor Aristotelian ten- in criticism, nor the stylistic tendency which derives from " Long- ' would give any justification to the assertion, that the *purpose* of is to be beautiful ; but in both it would be right to say, that when succeeds in its purpose, it is *judged* to be beautiful. But may there e, asks Burke, something better than beauty in poetry ? Is not pas- nore important than beauty ? This implies a somewhat limited standing of the word beauty, which becomes more evident as the ncy goes on. For Burke, beauty is to be defined in such terms as cacy," " smoothness," " grace," even " smallness." His argument hus. The free exercise of any emotion is in itself pleasant ; and the r the emotion, the greater the pleasure. Even emotions associated painful or terrible things are, as emotions, pleasant, provided they sinterested. In poetry, that is precisely what they are : the painful rrible things in poetry do not happen to us : we contemplate them, re only affected by the emotions which accompany them. These ons can then be freely enjoyed ; and those are found to be most g which accompany ideas or suggestions of death, destruction, lation, immensity, the unbounded, the infinite. That which as- es and overwhelms us with its emotional effect is what we call the ne : and this effect is usually produced by something which is in- e of apprehension. The effect is, indeed, that of terror ; " terror is in all cases whatsoever, either more openly or latently, the ruling principle of the sublime." And with terror usually goes some kind or degree of obscurity. The sublime, which is the true greatness of poetry, is therefore in general associated with obscurity in the idea represented : so much so that " a clear idea is another name for a little idea." It may be noted that this category of the Sublime admits ugliness as an element in poetry.

What is more important to note, however, is that this category of the Sublime is typical of Romanticism. Wherever we find Romanticism, we find the " inner " life somehow asserting its superiority over the " outer." Burke's insistence that poetry must be judged by its emotional effect is the first declaration of the rights of romantic criticism—criticism by purely subjective standards. And the romantic importance of " inner " experience over the " outer " world is further asserted by his insistence on the poetic value of obscurity in what is represented. For obscurity, like ideas of boundlessness and infinitude, sets the mind free to expand its inner powers unconditioned by the outer actuality of things. It is thus that, for romanticism, " distance lends enchantment to the view " : distance obscures, actuality becomes vague, and in its place Fancy " glows divinely there." It is scarcely necessary to observe that the opposite of Romanticism is Realism, which puts all its emphasis on the " outer " world. But realism, in the tradition of critical method, has never been anything like so important as romanticism.

Kant, in the *Critique of Judgement*, agrees with Burke that the sublime and the beautiful are distinct categories in the æsthetic judgement ; but seems to think that the pleasure in the sublime consists in the mind's recovery from the imminent overwhelming force of natural grandeur : by collecting all its strength to resist the overpowering effect of sublime landscape, the mind is invigorated by its sense of asserting its moral superiority over nature. Kant thought much more of the æsthetic judgement in scenery than in art ; but his discussion of the sublime in nature combined with Burke's treatment of the sublime in art to enlarge the range of æsthetic experience : thereby, of course, greatly enriching the tradition of criticism.

Less closely connected with romanticism, but belonging to the same line of criticism as Burke and Kant, *Lessing*, in his famous essay on the statuary group known as *Laokoön*,[1] considers the relations of literature with the graphic arts. Lessing easily admits, with Burke, that the ugly may successfully be introduced into poetry ; but this is because he limits more narrowly even than Burke the scope and meaning of beauty. Beauty is the ideal of the graphic arts ; but for poetry, expressiveness is the ideal : and ugliness may be very expressive. On the contrary beauty, which is given by shapeliness of visible form, may be destroyed by expressiveness. What Virgil's poetry can artistically do in describing Laokoön's horrible death, cannot be artistically done by the sculptor who represents the same incident in visible form. It is doubtful whether the facts bear out this particular argument ; but it leads Lessing to a very important conclusion.

The difference of effect between poetry and graphic art is due to the difference in the way they present their subjects, which again is due to the difference of their media. Owing to the medium of painting or sculpture, c art is the static representation of objects in single moments r existence ; whereas poetry, again owing to its medium, must be ccessive representation of actions in a continuous sequence of ex-. Lessing refers to an old Greek saying, attributed to Simonides, ainting is dumb poetry, poetry is speaking painting. This empha-ne resemblance between the arts ; but the difference between them ılly important. Painting must never seek to do what only literature o, literature never what painting only can do. But perhaps Les-d not perceive how radical was the distinction he maintained : riticism has also sometimes failed to perceive this. When a picture to " tell a story," does it really compete with literature ? How can ure present its subject in actual colour and form ? So, too, descrip-ı poetry cannot really trespass on the domain of painting. But g did invaluable service to criticism by emphasizing the boundaries ıg the arts. For whatever an art can do is conditioned by the m in which it is done ; and the rules which genuinely formulate an be done and what cannot be done in this medium or in that, are arily rules of an absolute validity.

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[1] Translated in Bohn's Library (Bell).

great contribution of romanticism to the tradition of criticism lies liberty of interpretation which it claims. This liberty denies the y of the so-called objective rules of a merely pedantic classicism, sily accepts the genuinely objective rules which, as Lessing showed, e founded on the nature of the artistic medium ; for these latter do not in the least interfere with purely subjective judgement. It omanticism that made possible the critical individualism, the com-iberty of appreciation, in Lamb, Coleridge, and Hazlitt. The danger encouragement romanticism gives to irresponsibility. But the last n the theory of romantic criticism, the perfectly balanced summation claims of liberty and responsibility, is given by Manzoni's formula preface to his noble poem *Il Conte di Carmagnola*. Every composi-ontains within itself the rules by which it should be criticized, or, as oni himself more carefully puts it, " offers to anyone who wishes to ne it the principles necessary to form a judgement of it." These ples may be obtained by asking three questions : What was the 's intention ? Was the intention reasonable ? Has the author car-t out ? In other words : *Discover* the purpose ; *judge* its worth ; *e* the technique. This puts Manzoni's meaning in the most general ossible, but introduces a slight modification of it.

ay be said, that in this there is nothing essentially romantic. And true : Manzoni's great dictum is only historically romantic. It was d as a protest against the doctrine of universal abstract standards in sm, to which false classicism and misapplied rationalism had per-the teaching of Aristotle, Horace, and " Longinus." Having ex-d that doctrine, Manzoni's formula becomes not merely a statement ideals of romantic criticism, but indicates the procedure of all sane sm whatsoever.

V. CONCLUSION

h Manzoni's wisdom, we may conclude. The pronouncement con-criticism, not theory. Every work of art is a particular case, and must be judged as such ; and the judgement must be of its merit. But the dictum is not quite so simple as it looks. How are we to know what an author's *intentions* are ? An author seldom tells us that, and when he does, his information is seldom to be trusted. For the reason why a work of art exists at all is, that it was the only way in which its author could truly give us his intentions. What he may say of them elsewhere will surely be more or less than, or beside, the truth. But if we allow the work of art to make its effect on us as a whole, then in that final unity of its total impression we have the author's intention so far as we are able to respond to it. This is universally true of art ; and it is a truth established not by criticism, but by the theory of art. Thus Manzoni's first critical principle is quite ineffective by itself, but becomes everything Manzoni intended it to be when it is based on theoretical principles. Precisely the same is true of the third part of his dictum. It is here that the paraphrase given above slightly modifies Manzoni's meaning. For if we know the author's intentions, we only do so because he has, somehow or other, carried them out. The real question is, *How* has he carried them out ? But criticism of technique is helpless without understanding of the general nature and function of technique, which only the theory of art can provide.

All this applies to the whole history of criticism. The rules of criticism, so far as they are valid, are nothing but modes of using universal theory in particular cases. They are thus objective rules ; and criticism, by virtue of them, need not wholly depend on the personal peculiarity of the critic. But the subjective element must come in. For it is entirely for its own purpose that criticism uses theory, a purpose which, strictly speaking, theory cannot assist : namely, to judge of merit. Obviously, nothing can limit the rights of purely subjective judgement on the question of merit. But as regards technique, if the criticism is at all considerable, the subjective judgement will be combined with judgement as certainly objective ; for here criticism must have regard to rules—not rules laid down by mere authority, but rules derived from the very nature of art, made available by æsthetic theory. There remains the second principle in Manzoni's threefold dictum : the worth of the poet's inspiration. The judgement here can be nothing but entirely subjective, and its freedom is absolute. Nevertheless, the value of the critic's judgement in this respect does not depend on its freedom ; it depends on the worth of the critic. When he is judging of technique, the weight of his verdict will largely be given by his intellectual qualities. But when he is judging of inspiration, the value of his judgement will depend on the whole man, on his moral and temperamental character, as well as his brain.

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THE ARTS OF PAINTING AND SCULPTURE

By

ROGER FRY

SYNOPSIS

is Article an attempt is made to gain some idea of the conditions : which paintings and sculptures have been made by man at ent periods and in different countries, and also of the different oses which those who made them had in view.

find that a great many of these works were made in response to n vital needs imposed on men by the complex conditions of n societies—these needs, for the most part, coming under the ng of publicity. Such works are, in effect, weapons in the gle for social predominance, means employed by men to increase mportance of their own personalities. Other works of art, we were created in response to supposed needs arising out of stitious or religious beliefs.

both of these cases the labour expended upon these works of s analogous to man's ordinary activities in response to the gle for existence.

t we find a whole class of works of art in which no such biological are envisaged—works due to a gratuitous impulse which we he æsthetic impulse. We find here a purely spiritual activity gous to that which impels men to search for truth. It is this free and biologically useless activity which has produced those s which are among the most cherished possessions of mankind.

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THE ARTS OF PAINTING AND SCULPTURE

INTRODUCTION

The arts of painting and sculpture have been practised by man since palæolithic times, for a period which has been estimated at more than twenty thousand years. One of the marks which distinguish the human species from the rest of the animal kingdom is the amount of time and energy which man expends on useless activities. By useless activities I mean those which are not dictated to him by his biological needs, either real or supposed. Play, the most universal of such useless activities, is the one, and almost the only one, which he shares with many animals. As far as we can tell from the records left by prehistoric man, painting and sculpture came next in regard to their early inception and wide distribution. In the life of the individual we find a similar precocious emergence of these arts, a passion for drawing being almost universal among children from about four years of age. And yet, deeply rooted as is the impulse to painting and sculpture in human nature, it would scarcely be an exaggeration to say that the average adult citizen of to-day would get through life with no appreciable difference if these arts had never come into being, nor is it unusual for him to look upon the artist as one of the least respectable drones in the social hive.

To be perfectly frank, one must admit that it would be no easy matter to persuade anyone who looked at life from a purely practical or ethical angle that there was any justification for the economic waste implied by these particular useless activities. Play he might admit as necessary to recuperate our forces for the work of the world; scientific research, though he would have regarded it as idle curiosity in its earlier stages, might be justified in his eyes by the advantages to our powers of production which are the fortuitous outcome of an activity that is, in aim, almost as useless as the arts. Such, certainly, was a very common attitude among many serious men throughout the nineteenth century, and the suspicion with which Puritans have always regarded the arts is far from extinct to-day, although it is less freely expressed.

We have then to face this fact, that throughout the immense period of human history and a great part of pre-history, the figurative arts have been practised in one form or another almost continuously and universally and yet that we have no very complete or cogent explanation of why man acts thus, with what precise aims, or impelled by what particular needs.

Impulses to make objects—to create, as it were, in play, animals or men which are objects of interest; impulses to imitate; impulses to relieve the stress of emotional states by outward expression; the desire to obtain a magical control of the forces of nature; the interpretation of life ms of desire ; an inherent love of beauty (whatever that may mean) these and other causes for this activity have been at various times ced as explanations. It is almost certain that various different im- s have, at different times and places, come into play in the fashion- f pictures and sculptures. The attempt will be made in the course of nquiry to distinguish some of these. We must also bear in mind the bility that even in a single work of art more than one aim has been aged and more than one impulse has exercised its sway.

e ideal of such a critical survey of the figurative arts as is here at- ted would be, so perfectly to read those works of art which different es and different ages have transmitted to us, that we should under- fully the precise mental and emotional conditions under which of them was conceived. That this ideal is unattainable is evident we consider that the critic himself, however much he may cultivate jective attitude, cannot altogether liberate himself from the spiritual sphere of his own time and country. It is not so very long, for in- e, since works of art of whatever country or period were estimated t entirely by their approximation to, or difference from, Greek art e fifth and fourth centuries B.C., which was accepted as an absolute ard of excellence. We may at least claim that whatever the prejudices hich we are unconsciously limited may be, we are at the present nore fitted, through our familiarity with a wider range of works of an has ever before been possible, to make such a survey with a little approximation to an objective standard.

fore actually entering upon the survey which is here contemplated, ust clear the ground by a consideration of what exactly we mean by seless activity of the figurative artist. Man is essentially a civilized al, that is to say that human beings, even those living under the most tive conditions known to us, even savages, as we used to call them frequently, when we knew nothing about them, than we do now— savages live in a society which has its rules and restrictions. It fol- from this that the biological struggle—the struggle for existence— part transferred from the plane in which it takes place in the animal , to other planes : that success will cease to depend entirely upon force, courage and cunning, and may depend upon pre-eminence rious activities which social man has come to recognize, whether y or wrongly, as having value. It thus follows that even those super- and useless activities, among which the arts of painting and sculp- ccupy, as we have seen, so prominent a place, may become the arena biological struggle. Though, in essence, useless activities, they may it were, recaptured and exploited by biological forces.

take a very simple instance of this, the drama began, as it begins in every child's life, as a pure play, as a satisfaction of gratuitous ntirely a-biological desires. But in our modern civilization there has up a vast business organization for the exploitation of this activity, would not be difficult to find writers and producers of plays who tuated by a pure desire for gain, who are functioning, that is to say, ling to strict biological need, who are true men of business. We have case where the free activity of make-believe which led to the drama een recaptured and harnessed to the biological cart, and becomes comparable to the primitive hunter's activity in searching for his daily food.

This possibility of recapturing and harnessing the free activity of the arts must be steadily borne in mind in studying the history and evolution of sculpture and painting, since at every step it complicates and confuses the situation. In examining any work of art, we shall want to discover, if possible, how far it was conceived in response to the free impulse which we may call the æsthetic impulse and how far it was conceived with biological or business ends in view.

We shall, in our survey of the arts, find these two forces continually acting and re-acting on one another with continually varying resultants. The quite recent developments of our capitalistic civilization have, curiously enough, brought into strong relief one of the great biological uses to which the figurative arts can be put. Before America had discovered the hypnotic influence of pictorial images on the public, the man of business had nothing to say to the artist with the sole exception of the portrait painter who was able to minister to his sense of self-importance. All other artists he regarded as certainly useless, probably mischievous, parasites upon society. But with the advent of advertisement the man of business has had to make terms with the artist, since the artist's activity has become a means towards the creation of wealth.

Now this twentieth century example of the relations of biological need, or business, and the æsthetic impulse throws a great deal of light on the arts of painting and sculpture throughout past ages. We shall find in fact that advertisement, or publicity, in one form or another has been one of the chief incentives to the production of painted or sculptured images. That, for instance, certain colossal statues of Pharaohs are clearly analogous to colossal portraits of ladies whose complexion has benefited by a particular brand of soap, or of gentlemen whose hilarity is due to a famous beer.

We must now consider a little more closely how the painted or sculptured image which has been ordered in response to the business instinct of the advertiser comes into being. The advertiser himself cannot make it, cannot even conceive it except in the very vaguest way. He therefore sends for an artist and tells him vaguely what he wants. Now the artist has presumably had a professional training. He has the technical skill necessary to fashion an image according to the accepted standards of his time and country. If he has nothing more than technical skill and if, in order to earn his living, he seeks merely to satisfy the demands of the advertiser, he too will be governed by biological need, and the whole production of the image from beginning to end will show no evidence of free activity whatever, no æsthetic impulse will have intervened, we shall be dealing only with the play of relatively simple biological forces acting in the complex ambience of a highly organized civilization.

On the other hand the artist for whom the advertiser sends may have, besides his technical professional skill to make imagery, a strongly marked impulse to free creative activity ; his imagination may be so obsessed by a particular kind of imagery that he will seek first of all to externalize that imagery, even though it may be quite different from the sort of image that the advertiser wants, or he may try to conciliate the two s ; but, at all events, he will have an impulse to "free" unconditioned tion which he will try to satisfy at all costs. If this impulse is so over- ering that the artist is quite incapable of modifying his imagery in way in order to satisfy the exigencies of other people, we may call a pure artist. It is evident that the pure artist can only come to terms the pure business man if he can by some means persuade him that the artist's, imagery is likely to have a stronger hypnotic influence he public than the one which the advertiser had vaguely presented is mind.

e may, I think, with these facts in view formulate a law of art history: ry type of imagery which has come into existence tends to persist in same form, except in so far as it is acted upon by a free æsthetic ulse.

s might be supposed however in so complicated a matter as art, this is only approximately true, because in reality any type of imagery ch persists without æsthetic intervention for any long period tends slowly to undergo degradation. This degradation may be of various ls ; the essentials may be overlaid with gratuitous ornament or the may become vaguer and less explicit, but in one way or another its inal significance tends to become obliterated.

et us summarize briefly the situation to which we have been led by the ious considerations. When we view the whole corpus of works of rative art which the past has handed down to us, we see that they come into being as a result of many different impulses—we see that y of these impulses have a biological value and that works of art may me counters in the game of life. But we find also, running through whole mass like gold threads in a tapestry, here appearing brightly there lost sight of for long periods, the evidences of that specific ee" activity—"free," in that it is unconditioned by biological need— ch we will call the æsthetic impulse. Whether that impulse can , in some much more hidden way, be connected with certain funda- tal instincts, or whether we should regard it as a gratuitous flow of energy, we cannot now stop to enquire. For the time being will take it as an unanalysed datum of human nature. Whatever its in or psychological constituents may be, it is this æsthetic impulse ch gives to works of art their spiritual significance. It is the re- ence of this æsthetic impulse at various times and in various countries has built the spiritual habitations to which all men who have the ssary sensibility to apprehend works of art have the right of entry.

e have seen that advertisement, or publicity, in one form or another e of the chief social functions of art, one of the ways in which æsthetic ulses are made to subserve practical biological ends. There is another l use of the work of art, closely connected with this, which we may ify as the luxury value of the work. This is ultimately one of the ways hich the individual proclaims his social superiority over his fellow . Professor Veblen, in his *Theory of the Leisure Class*, has developed explained this phenomenon. People desire to proclaim that they be- to the dominant caste in society, the caste which directs and rols the working classes and enjoys the fruits of their labour. The effective way to do this is to show that they possess the spoils of victory in the social struggle. Objects which are rare and generally coveted, such as gold and precious stones, are the most obvious means of such display of social superiority. But objects which are the result of prolonged and skilled labour are equally, if not more, effective, since here also the supply is limited, and they are even more striking evidence that the efforts of the best of the workers are exercised for the owner's benefit. Works of art in which this particular demonstration of social superiority is envisaged we may call objects of luxury. Since, until quite recent times, such objects were made by hand, and since it requires special aptitude and long training to control perfectly its movements, absolute precision of line and mechanical exactitude will be evidence of assiduity in the workman and rarity in the object. Similarly, the obliteration of all traces of the actual strokes made by the artist's tools in the execution of the work implies a final process in which the artist's work is to obliterate the traces of his own previous work, by polishing and smoothing away all irregularities. This last perfection of finish, for which craftsmen have adopted the excellent term "shop-finish," is very characteristic of the object of luxury, as we may see any day by looking in at the shop windows in Bond Street, Fifth Avenue, or the Rue de la Paix. The pure craftsman as such has always aimed at mechanical perfection of finish. The machine-made object is an unexpected realization of his ideal. But this ideal is directly contrary to the artist's æsthetic feeling. It denies a fundamental need of that impulse, the need to express sensibility. We must therefore try to make clear what this sensibility of the artist is, and what it implies in the work of art.

The full recognition of this quality in works of art is of relatively recent date. The quality itself has indeed always existed and has always appealed to receptive spirits, but the full consciousness of it as essential to a great work of art was impeded so long as we accepted the Greek idea of beauty and perfection as the aim of art.

A good example of what is implied in the word may be taken from architecture. The beauty of a Romanesque façade resides not only in the general ordering of the parts in relation to the whole, the proportions of the different members, but in the way in which mouldings and ornaments are carved. The craftsman who did these was no doubt given the general outline of mouldings and indications of floral ornaments, but he cut these according to his inevitable personal apprehension of the forms, with continual slight variations from the geometrical idea. Now we all know what happens when such a façade has been restored by a nineteenth century architect. Since the modern workman was trained to follow the given geometrical idea with unvarying mechanical precision, the mouldings have exactly the same contour throughout, each of the repeats of a meander is identical, and so forth, and the result is disastrous. We shall see the reason of this when we reflect that in a work of art, what gives us the special æsthetic pleasure is the recognition that the matter of which the work is made has been, as it were, penetrated and impregnated by an idea with which we associate ourselves. We see something akin to our spiritual being penetrating and moulding matter. The fullest pleasure occurs when, having realized the general idea, the main relations of the members of a building, the main composition of a picture, disposition of the limbs of a sculptured figure, we are able to sider the interior relations of the parts, proceeding always from larger maller relations, without finding any point at which the informing breaks down, until we come to the matter of the work, the grain of stone or the canvas. It is important that we should feel at every point impregnation of matter by the idea. The presence at any stage in process of any mechanically precise statement of form causes a gap ; feel that a link in the chain that binds matter to the informing spirit roken. In a work like a picture or sculpture, if it is original and en- y by the master, we are able to see the same sensibility (that of the t himself) working at every stage, down to the minutest touch or chisel ke, upon the material. A proof of how highly the sensibility expressed he minor relations is appreciated is given by the relatively small rd shown for copies and pupils' work, which none the less give the er proportions as well as an original. In a building, such an all- ading expression of the designer's sensibility is of course impossible, we content ourselves with the subordinate sensibilities of the crafts- . But in any case, what we desire in a work of art is the feeling of an haustible wealth of significant relations which lie ready to hand for investigation. We feel at once that a work of art has an idea that is lligible, and that it is infinite in its possibilities. It is this feeling of ity which gives to the embodied idea its organic completeness and queness, and distinguishes it from a geometrical figure which is finite capable of repetition.[1]

PALÆOLITHIC ART

s might be supposed, the very earliest evidences which we possess of nan handicraft were dictated by sheer biological need—of this nature the flints which were shaped into cutting, piercing and hammering s. With the advent of Aurignacian man, after many thousand years, still at a period which is estimated at over twenty thousand years ago, e occurs a great output of both sculpture and painting—executed on rock faces of the caverns in which these men sheltered. With the eption of a few small statuettes of female figures, these works are fined to representations of the animals—horses, bisons, mammoths and bears—which were man's enemies or his prey. These representa- s are unlike any other works of painting and sculpture that have ever n produced in subsequent ages. In the first place, they show by their ving of animals in movement that Aurignacian man possessed a dity and sureness of eye which no other race has approached, since ecognized poses, the truth of which has only been revealed to us nstantaneous photography. Secondly, the Aurignacian draughtsman the animal as a whole without any untrue emphasis on the separate ures. In particular, the eye is not made either bigger or more marked n it would be in a photograph. Now in all subsequent art we note that almost impossible for a draughtsman not to emphasize and generally enlarge the eye, on account of its predominant attraction for our regard. This would seem to suggest that Aurignacian man had not developed a full conceptual language, that he had not made that rather complicated series of deductions by which we recognize the similarity of function and nature of this organ in whatever animal we may be considering—deductions which are summed up in the word "eye." Thirdly, these drawings are scattered on the walls of the caves without any idea of order, and often one artist will impose an image right across a previous drawing. There is, that is to say, no trace of any impulse to decorate the surface by an orderly symmetrical or balanced arrangement of the forms. In contradiction to this, the work of almost all existing primitive peoples is mainly dominated by the idea of pattern and decorative effect. However, this need not mean that Aurignacian man was entirely devoid of the decorative impulse—we find indeed suggestions of it in some of his bone carvings—but rather that the surface of his rock, without any evident boundary or limitation, failed to stimulate this impulse. We see the same phenomenon in children's drawings. A child who has got hold of a large sheet of paper will cover it with all sorts of images thrown helter skelter over the surface ; but give the same child an object like a box to paint on, and he will instinctively put some symmetry or rhythmical repetition into his forms ; he will inevitably relate each part in some way with the limiting boundary.

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[1] See on this question, Charles Maurron: *The Nature of Beauty in Art and rature* (1927).

The question has naturally arisen—Why did these Aurignacian men, who must have lived a life of the utmost hardship, subject to a terribly severe struggle for bare existence, expend so much energy and effort on these paintings and still more on the high relief carvings of their rock walls ? Some writers have imagined a high degree of civilization, arguing from the fact that naturalistic representation has generally only been accomplished in old and sophisticated cultures like those of the Roman Empire or of modern times. Everything we know of Aurignacian man makes such a theory fantastical. Others have sought more rationally to attribute this activity, in appearance so great a waste of effort, to a supposed biological function. They have suggested that the primitive hunters made these images as a means of giving them control over the animals themselves. In favour of this we find indeed some paintings in which the wounds by which the animal is killed are represented, as though the hunter, by wounding the image, would thereby acquire a magical power to wound the original. Again, by sympathetic magic the multiplication of the images may have been held to cause an abundance of the animals which were necessary for food. There is great probability in this theory, since it is a common result of primitive mentality to regard images as in some way identical with the object imaged ; and this extends to reflections of a person in water or to the imprint of his footsteps. Power over the images or imprints gives power over the person. But while accepting the magical theory it does not explain everything. If magic had alone been considered, these painters would almost certainly have developed some kind of hieroglyphic, since any image, however distorted, so long as it was recognized as standing for the animal, would have the same magic power, and in that case the law of least effort would have brought about a rapid degeneration of the imagery. But this is not the case, for the drawings are st always carried out with great care and the complete realism—par-rly in the case of certain sculptures and clay models—has been ed to a high degree. It seems probable therefore that these people repaid for their toil by some intense satisfaction; that there was a ite object in their image-making for its own sake. We see from ob-ng children that whenever their emotion about any external object, as an animal, becomes intense, there is felt a need to externalize the sive image. A child who has a passion for horses will cover endless with representations of whatever shapes it has adopted as expressive orse. The difference between these Aurignacian drawings and those ildren lies in the vastly greater power of those early men to hold a lly exact mental image and subsequently project it unchanged upon all. It is almost as though those images which had most interest for unter were photographed on the retina, ready to be transferred to all surface later on. If I am right, then even these very early exam-of painting and sculpture show man's willingness to go beyond gical necessities for the sake of gratuitous and non-biological actions, for a rudimentary kind of spiritual life.

NEOLITHIC ART

om the remains which he has left us, Neolithic man seems to have his energies more intently towards practical ends than his Aurig-n predecessor. The discovery of the art of pottery added a new ort to life. The smooth surfaces of his pots replaced the rough walls ves as depositories of man's visual imagery. But these surfaces, with fixed boundaries and special shapes, imposed great limitations on ainter. The pot itself was already a creation of the artist; his first was to enhance its value, and he was willing to subordinate his -making propensity to this purpose. Inevitably his painted forms decorate the pot. And the easiest way to do this was by the repetition nple geometrical patterns running round the body of the vessel. ven when Neolithic man set out to represent animals or men, he ed no evidence of that extraordinary power of seizing and stating the visual impression of things which places Palæolithic painting in a ory apart. He drew, as most children begin to draw, by means of a of symbols for the component concepts of the object. For example ng child's drawing of a man consists of a circle, the simplest symbol e head, a vertical line, the most abbreviated symbol for neck and , a straight line for each of the limbs, ten short lines for the fingers o on. This symbolic summary betrays a total indifference to actual impression. It is rather a hieroglyphic statement of the different pts—head, arms, fingers, etc. It is far nearer to verbal description o a visual record. If, as we may suppose, Neolithic man had elabo-a fairly complete conceptual language, it may well be that this had yed in him his predecessor's power of apprehending a total un-ed impression. The concepts of the separate parts having divided imal into its components, the animal itself had to be expressed by pounding these parts. It could no longer be apprehended as a entity. It is hardly an exaggeration to say that a great part of an artist's training to-day is occupied in learning to counteract the distortions introduced into our vision by our conceptual language. As an instance of how profoundly this conceptual interpretation of our sensations go, we may cite the well-known fact that in cases of hysterical hyper- or an-æsthesia the area affected always corresponds to some conceptual image such as hand, wrist, forearm—it never occupies a vague undefined surface of the body.

Thus almost any artist begins by making the mask of the face too large in proportion to the skull. His attention being seized by the components—eyes, nose, mouth—he allows these to encroach on the nameless and undifferentiated surfaces of the skull. The difficulty of learning to apprehend any part in correct relation to the whole visual surface is very great, so great indeed that many very remarkable artists never quite acquire it. And yet this difficulty was apparently non-existent to the Aurignacian cave-man.

ART OF PRIMITIVE PEOPLES

In the art of the Bushmen of South Africa, there appears to be a survival of the attitude of Aurignacian man. But the art of all other primitive cultures of to-day corresponds in its main outlines with that of Neolithic man and of the bronze age. In all these, the elaborate decoration of surfaces with more or less geometrical patterns is the main preoccupation of painter and sculptor. Representations of natural objects are no doubt very frequent, but these representations have been so much modified by repetition, and by the need to adapt them to the decorative schemes in which they are incorporated, that they are often extremely hard to recognize. Indeed, it is often only when we put together a long sequence of such repeated forms that the representative basis of a pattern can be discovered. Here again we are at the opposite pole to Aurignacian man, who seems never to have used such convenient shorthand hieroglyphics for the multiplication of an image.

In primitive civilizations of to-day, however, sculpture is often employed with a more representative content, both in carving statues of gods, or ancestral figures, and in making masks to be worn in ceremonial dances. Such masks exist among almost all primitive peoples. What is most unexpected about these is that whether they come from the Indians of North or South America, from the various tribes of Central Africa, from Oceania, Indonesia, Polynesia, or New Zealand, they all have a general similarity of aspect. In almost all we find extensive distortion of the actual forms of the human or animal face. The eyes may be reduced to two small holes or slits, or they may make themselves globular protrusions, the nose may be an extremely long ridge down the flat surface of a mask or it may be a mere lump, the mouth may be made into a colossal grin, which displays rows of immense teeth, or it may be contracted to a slit or even suppressed. Naturally enough, for long after these sculptures became known to modern European man, they were regarded as the helpless stammerings of peoples incapable of rendering the human form truly. These deformations appeared to be due to mere incapacity. But as a result of the much wider outlook upon the art of the world which has

ntly become possible, such a view is no longer maintained by serious
ents of art. Indeed, such a view might well have been rejected by any
ptor who looked at these works with an open mind. For the finer ex-
les show that the artist had no hesitations, that he carved his forms
remarkable sureness of hand, and that his hand was guided by a very
ng feeling for harmony of proportions and continuity of rhythm. The
rted features are no accident, they are designed to produce a par-
ar effect on the spectator. In general they represent dead ancestors
e tribe, and they are inspired by a kind of ghostly and supernatural
They do express something of the horror of death and the fearfulness
an's dreams of the supernatural. In all these works the artist is con-
ed not by the literal facts of nature, but by a vivid instinctive appre-
ion of the psychological significance of certain forms and of their
hmic harmony. The fact that these works, from whatever quarter of
globe they may come, betray a closely similar method of expressing
in feelings, gives us the hint that probably certain patterns of social
nization and certain levels of intellectual attainment and emotional
ts are likely to find expression in a particular kind of art, with its own
m of understanding the relations of form.

his idea is confirmed by the fact that modern European man showed
incapacity to understand these works, when he first became ac-
nted with them, precisely because in more highly developed social
ms men generally demand that the imagery of art should correspond
or less closely with the actual appearances of nature. The imagery
h appeals most to the ordinary man of our modern civilization is that
h corresponds most to the photograph.

he art of these primitive peoples is singularly pure. That this should
is not surprising when we consider that the social organization has
at this stage, discovered and exploited the publicity value of art, and
remains therefore a direct expression of the sensibility. Thus those
rences which do exist in the arts of these primitive peoples may be
as corresponding to innate differences in the æsthetic sensibility
e various races. And here undoubtedly two races stand out as
emely gifted, the Polynesian and the Negro. Many objects made for
nal use or ornament show the keenest sense of plastic harmony, the
delicately just proportion and organic design. In the making of
es, whether of deities or ancestral figures, African art is however
the richer and the more advanced of the two.

the figures, as in the masks, what strikes us is the expression of the
life of the imagined being, and this again in spite of the most in-
ct proportions and extravagant distortion of the actual human form.
vital reality is achieved by an instinctive sense of expressive form and
e coherence and inevitability of the plastic relations. Although much
an sculpture is rough, grotesque, and sometimes merely income
nt, it never altogether belies the artist's sensibility, or aims at mechan-
nd surface perfection. But what distinguishes it from most sculpture
e surprising control of three dimensional form that these artists
ss. In most races sculptors, like painters, find it easier to conceive
in its greatest extension to the eye, either full face or profile, and
tors liberate themselves only slowly, and at the end of a long period

of tradition, from this inclination to conceive objects in the flat. Even in the mature style of Greek sculpture we find traces of the four sides from which the sculptor has worked. The figure results, as it were, from the convergence of four flat reliefs. But in Negro sculpture the artist appears to conceive from the first equally easily in all dimensions.

MEXICAN AND PERUVIAN ARTS

The arts of Central and South America are of peculiar interest, in that here we find quite complex social organizations capable of controlling a large co-operative effort for great public works, which none the less retained the essential qualities of the art of primitive peoples, perhaps in part because they continued to use the implements of primitive man.

The Mexicans lived an orderly and well-regulated life. Even their Spanish conquerors were impressed by their careful cultivation, their well-planned towns and excellent houses. This life they carried on under the tyranny of one of the most bloodthirsty theocracies which have ever been invented. The very cruelty of their religion was, however, a function of the extraordinary vividness and exuberance of their apprehensive imagination of the unknown, and this intensity and fertility of imaginative conviction gives its concentrated power to their plastic creations. Thus whilst the actual imagery is so charged with macabre and sadistic horror as to check our appreciation, the unconscious feeling which betrays itself in the choice of proportions and the plastic rhythms themselves often commands our ready acquiescence. In the more definitely religious works, like the great sculptured monoliths, the extravagance of Maya mythology leads to an intricate interweft of symbolic forms which, in its tropical exuberance, resembles somewhat the equally religious art of India. But, unlike that of the Hindus, the native sensibility of the Central Americans led them always to hold this multiplicity within the framework of a broadly conceived architectonic unity. In certain individual figures and in many masks, where no religious end seems envisaged, Maya sculpture has a placid and austere beauty of proportion and a sensitiveness in the modelling which has rarely been surpassed. In a judicial estimate we must, perhaps, admit that these people, working only with stone-age tools, have left us more masterpieces of pure sculpture than the whole of Mesopotamian, or than the majority of modern European, civilizations. Their painting, which we know only through miniature, is too purely hieroglyphic and conventional to have much æsthetic significance. They tended evidently to regard both low relie and painting in a more purely descriptive and expository light than thei sculptures in the round or in high relief.

Peruvian art, which has evident affinities with that of Central America is less macabre and horrible in its imagery. It agrees with all that we know of their relatively humane civilization. It does not however give proof o quite so intense and vigorous a plastic feeling, though some of the anima heads and the rare portions of human figures from Tihuanaco are suprem in their broad and significant simplications. On the other hand, some o the Nazca pots, made in the shape of human heads, are literal naturalisti ularly like some later Gothic sculpture and, like that, lack- Such a non-æsthetic curiosity about verisimilitude is ex- in the arts of primitive peoples. On the other hand the pots ornament, either geometrical or naturalistic plant-forms, est feeling for proportion and an austere subtlety of taste nly be paralleled in the greatest works of European and This firm grasp, this tendency to affect recti-linear, or at controlled linear, and plastic rhythms which marks the art ent American civilizations is somewhat surprising in view agance, not to say monstrosity, of their invention. It makes finest works strangely similar to the best achievements of llectually gifted civilizations of the old world. And yet they e retained an essentially primitive and pre-logical mentality.

EGYPT AND MESOPOTAMIA

nse duration of Egyptian civilization, with relatively little life of the average citizen throughout its thousands of years, it was a remarkably successful solution of the problem of ne desires of the individual with the claims of society. oubt counted for much, but the tone of such representations as remain, suggests that as a people the Egyptians pre- l pleasures to the love of power and that they cultivated inement and discrimination. Such a people would be likely ural aptitude for the visual arts, and in fact we find under- t artistic production of Egypt a peculiarly instinctive and e of visual harmony.

e to admit that works of genuine æsthetic value form but a rtion of what has been left to us. We cannot doubt that non- s largely dominated their artistic productions. These needs to the religious and political conditions of Egyptian society. s ever been so much obsessed as the ancient Egyptians by future life, above all by the idea of that life inhering in the the desire to preserve the latter for all eternity. In conse- arly Pharaohs strained even the vast economic resources of construct the most perdurable and infrangible homes for ies. The logical outcome of this was the pyramid, a marvel hal engineering and masonry, but too purely utilitarian, too rical to express complex æsthetic feeling. The same feeling after death led them to furnish the tomb with simulacra of daily life and to cover its walls with pictures of their asures whilst on earth, since these would still be their con- he grave. But since these images had a purely practical it was only needful for them to be recognizable symbols of the quality of the representation, beyond the necessary erisimilitude, was a matter of indifference. To give to these would have been a gratuitous waste, and when we find e undertakers kept tomb chambers ready painted for the clients, we can see how essentially commercial and non- sult was likely to be.

Church and State were indissolubly united. The Pharaoh was believed to be the actual offspring of a God, so that religious and state art were indistinguishable. Now this religious state believed in the hypnotic effect of publicity on the people it governed almost more fervently than the modern oil or beer king. That this psychology was sound is proved by the fact that the advertisements in which they proclaimed their value still continue to work on the modern tourist by reason of their mere size, costliness and magnificence. When a king like Amenhemet I left ten identical replicas of his own statue at his tomb, we can see that his aim was practical and non-æsthetic. Moreover, like all highly organized religions, this intense state-religion of Egypt tended to extreme conservatism, and the artists it employed were forced to conform to a rigid and unchanging convention. This explains a curious fact common to most early art but more continuous in Egyptian art than elsewhere, namely that sculpture in the round attains to a more or less complete realization of natural form, whilst painting and bas relief (which is in effect a form of outline painting) remain at a relatively elementary stage. Sculpture, naturally enough, arrives first at a representation of natural form, since it is a three dimensional copy of a three dimensional object. The sculptor has merely to make each plane at the same inclination, and of the same size, as the original to arrive at his image. But to project the three dimensional objects of nature on to a flat surface, which is the problem of pictorial representation, is far more complicated. The size of any given plane will depend not only on its actual size but on its inclination to the line of vision. A plane, however large in reality, which is strongly inclined to the picture-plane may be reduced to a very small apparent surface. Perspective is the science by which we can estimate exactly what distortion the actual form of objects must undergo in appearance when seen from any given angle, and this science was only attained in highly intellectual and advanced civilizations.

The artists of early Dynastic and pre-Dynastic Egypt, by their keen aptitude for observation and their acute sensitiveness to form, had very quickly mastered the representation of the figure in the round, at least in its simpler poses, but when they came to represent objects on a flat surface they took the easiest course, namely that which avoids as far as possible perspective distortion of the actual form. This easy course, which is discovered anew by almost every child, consists in choosing always the aspect of greatest extension parallel to the picture plane. To take a simple instance, the greatest extension of a penny will give a circle as representational form, the least extension will give a single line and the intermediate extensions will be ellipses. A circle is a much more legible symbol for a penny than a line. Similarly, the shape of an arm stretched at right angles to the observer (*i.e.*, parallel to the picture plane) will be not only more legible but more easily drawn than an arm stretched straight at the spectator, in which case every plane will undergo violent distortion by reason of its foreshortening.

On these principles, the Egyptians at an early date elaborated a very complete system of linear description of objects seen always in profile or full face. The relation of these objects to one another was represented also in two dimensions only, or with only the vaguest hint of recession.

s this elementary, purely descriptive, delineation which religious rvatism petrified, so that it persisted for many centuries with scarcely hange.

n portrait statues, since they helped to preserve the original man he decay of death, served biological, or perhaps we should say metaical, ends. For this purpose they were preferably made of the st stones, such as diorite or granite. And here, for once at least, the ical datum actually furthered the æsthetic end. The artist, for all tent and skilful craftsmanship, was obliged to find the simplest le scheme in which to express the more fundamental plastic relaof the figure, and this helped to impose an æsthetically valuable so that some of these early realistic statues have considerable beauty gh the descriptive rather than the creative purpose tends to become ent in spite of the broad simplification of the form. Even here the s personal sensibility does not function fully. This descriptive ncy of Egyptian art was also perhaps influenced by their strong ctual bias. This would naturally make them desire a particularly precise and definite statement of form. As we have seen, æsthetic ility envisages at the same time the coherence of form, its cony to a single idea, and also the multiplicity and infinity of our sensations. Certainly the Egyptians tended to suppress this aspect sibility, to freeze their lines and polish their surfaces into mechanirfection. We have also seen that the luxury motive in artistic pron tends in the same direction, in its love of expensive shop-finish. esult is that the vast mass of Egyptian objects of art have the stamp nmercial production, and appear to be uninspired by any æsthetic And the same is true of the greater part of their official art, in which haraohs advertised their prowess and success.

ne the less the native æsthetic feeling of this strangely gifted people dden beneath the frozen surface, ready to emerge whenever it got nce. At almost every period a careful search will reveal here and a genuine work of art, generally in some minor object or statuette by some lucky chance the artist was free to create independently. e great proof of this extraordinary situation lies in the volcanic outof an intense æsthetic sensibility which Akhenaton let loose. This al prodigy among kings succeeded, by sheer force of conviction, in ng for a moment the age-long crust of convention which bound the sensibility of the Egyptians. That this is no wild hypothesis we ll from the fact that his chief sculptor declared that the King had him. Without supposing this to be literally true, we cannot doubt totally new direction was given to art under this King. Everything for and under him had a free vitality of rhythm unapproached ere in Egyptian art. A little torso of a girl's figure in University e, London, which is said to be part of a portrait of the King's ter, has a tremulous sensitiveness of modelling which in this surpasses anything pronounced by Greek art ; whilst for subtlety dividuality of expression, some of the portrait heads at Berlin which rom the royal studios anticipate the best work of the Italian Renais-But this bid for freedom died with the King who had inspired it, s son-in-law Tutankhamen's tomb was found to be filled with the most expensive rubbish that money could buy from the most fashionable furnishers. But though it was suppressed, nothing could actually kill this native Egyptian propensity. Again and again we see it flickering beneath the surface of Ptolemaic art, and before the dissolution of the Roman Empire it had blossomed out into the free and playful fantasy of Coptic art.

The civilization of Mesopotamia seems to have started at about the same early period as the Egyptian, to have progressed almost more rapidly, and to have acquired technical accomplishment in sculpture, metal work and pottery before 3000 B.C. This civilization seems to be due entirely to the Sumerians, a non-Semitic people. Men of Semitic race lived in Mesopotamia even before the arrival of the Sumerians and later on became the dominant race, but everything that shows æsthetic impulse and creative power can be traced to a Sumerian origin. The Sumerians were a people of extraordinary organizing and commercial ability, but if we may infer from their imagery they had little of the refined sensuality, the reflective enjoyment of the pleasures of life and of the beauties of nature that characterized the Egyptians. We may infer from the wholesale human sacrifices that marked the burial of the earliest Kings that they too lived under a theocratic tyranny. This never seems however to have hardened into so thick a crust of convention as in Egypt, being prevented perhaps by the alternations of predominance among various rival city states. In any case, Sumerian art is freer than that of Egypt. Their artists seem to have striven rather for expressive vitality of rhythm than for the suave perfection of smooth surfaces and unbroken contours. They were relatively indifferent to the plastic possibilities of the nude human figure, and it is only in the modelling of the head, and occasionally of arms, hands and feet, that we can estimate the degree of sensibility to which they attained. This, in a few cases such as the portrait head of Gudea in the Louvre, is of a very high quality. The broad synthetic grasp of the general structure of the head marks a great artist, but he was capable also of the subtlest and most delicate modelling within the limits of this general scheme. Comparable with this are two heads of the third Dynasty at Ur, which rank among the masterpieces of sculpture. These all belong to the climax of Mesopotamian art, in the latter half of the third millennium B.C. The earlier work discovered at Ur shows considerable uncertainty of style. We find sudden appearances of literal naturalism in certain animal forms, and this does not seem to be connected with the general trend towards a decorative stylization. In many of the reliefs, inscriptions are not confined to the background but run right across the figure, a sign, among many others, of the essentially illustrative and didactic attitude to art which the Sumerians adopted. The publicity value of the official and religious art is constantly kept in view, and in the objects made for personal use which we know best from the earliest periods at Ur, the luxury quality is far more marked than the æsthetic. On the whole, we get the idea of a people but little inclined to the detached and reflective attitude necessary for artistic creation, but withal so naturally gifted that every now and then the craftsmen whom they employed for their practical publicity and luxury ends were capable of great æsthetic achievement. Their art never falls into the academic professional accomplishment which deadened so much of Egyptian art ; it is always vigorous, pedantic ; but, on the other hand, the Sumerians were as a people tle interested in art to concentrate their activities upon it. They ny marked inclination towards sensual refinement and its æsthetic nes.

h the predominance of Babylon in the early part of the second nium the Sumerians became permanently subject to their Semitic ours, who had however adopted Sumerian culture. None the less mitic control seems to have put an end to all possibility of æsthetic . The fourteen centuries of Babylonian and Assyrian rule pro- no new artistic motive, and art, accepted merely for the publicity of its imagery, repeated the stock motives it had inherited from ian masters. This art was entirely subservient to the practical pur- of propaganda and publicity—to the advertisement of the super- prowess and ferocity of the Kings and their divine masters. from the hideous cruelties which are so complacently detailed, the sis was laid always upon what might serve to suggest irresistible force and violent energy. Almost all sensibility to plastic harmony eared, and the art became one of descriptive illustration with a feeling for the decorative effect of repetitive lines. Just as the an empire was about to fall, in the eighth century B.C., there super- a certain tendency to greater elegance in the proportions and more in the drawing, but on the whole we may say that from the ic point of view Mesopotamian art ceased to contribute anything e with the fall of the Sumerian power.

ÆGEAN

hese great rigidly organized states the civilization that sprang up Ægean forms a marked contrast. It suggests to us a people grouped r into seaport towns by their common interests in fishing and ne trade or piracy. The social system being relatively elastic, the ual was not overwhelmed by the power of the state and there was a ing of democracy. Under these conditions, we might expect to find e sensibility of the individual would recover something of that tive quality that we find in primitive peoples, and which we saw was suppressed in the early highly organized empires. And to some this is true. The Ægean artist chose for the subjects of his painting s, his frescos on walls, or his embossed metal work, almost any objects that had attracted his interest or attention—cuttle-fish, s, seaweeds, or scenes of contemporary life, bull fights, acrobats, at festivals, fashionable ladies. He shows a restless, capricious y, and a natural child-like enjoyment of the pleasure of life which him off from the Egyptians with their more reflective sensuality ir preoccupation with the life after death, and the Mesopotamians eir indifference to natural beauty, and their strong social religious But strangely enough the sensibility thus released seems to have a rather poor quality. Ægean art is conspicuous for the feebleness ythmic sense, its want of feeling for clearly organized formal rela- o find any equivalent to the weak inconsequent rhythms and the ence of structure of Ægean art, we have to turn to the style which appeared for a short time at the end of the nineteenth century in Europe called *art nouveau.* That was largely the result of amateur artists discovering an easy and thoughtless method of decorating a surface. And, in effect, Ægean art is marked, in spite of its technical skill, with amateurishness in the sense that it was satisfied with casual and rather lazy impromptu inspirations, that no attempt was made to discover the full implications of any idea. The artists never tried to condense their casual impressions and sensations into a clearly articulated synthesis. Their images have of course their interest for us as sketchy illustrations of contemporary life, but they have very little value as creations of formal harmony. Ægean art cannot, I think, show us a single masterpiece ; nowhere do we find that sustained effort to realize fully, and in all its purity, a formal synthesis such as we find scattered in isolated examples through the long sequence of Egyptian art, or as marks a few happy moments of Sumerian art.

GREEK, ROMAN, ETRUSCAN

In Greek civilization at its height sculpture and painting were cultivated with an intensity and vigour which have rarely been equalled. The artist of this period became fully conscious of his rôle as an interpreter of the spiritual life of man. Art was for him a sacred vocation, to which he was dedicated by his talent. Such a recognition of the high purposes of art, when the artist is regarded as the equal of the poet and the philosopher, has only occurred at rare intervals. The situation in Greece during the fifth and fourth centuries B.C. may be compared to that of China in T'ang times, of Italy during the Renaissance and of France since the reign of Louis XIV. Undoubtedly there were some approximations to such a situation at various times in the history of Egypt. Architects in particular gained the recognition of the importance of their individual initiative. Such a situation implies not only a considerable excess of wealth over what is necessary for existence (some surplusage being, of course, necessary for any kind of art), but a desire on men's part for those purely disinterested spiritual satisfactions which come from the love of Beauty and Truth. For we may note that these periods of what we may call the self-consciousness of art have always occurred during periods of free intellectual speculation.

One evidence of this state of things, where the spiritual value of æsthetic creation is accepted as valid, is the recognition given to the individual artist. He signs his work, and his name may be quoted as one who confers honour on his country. More usually the artist has to satisfy his impulse to realize æsthetic synthesis under cover of some pretext or other ; he has—to revert to our original analogy—to make an effective advertisement. But in these rare halcyon periods of art-history this independence from all other than æsthetic necessities is more or less complete.

Yet Greek art is not only the first entirely self-conscious art that we know of ; it stands apart from all other traditions in its almost exclusive research for beauty, and in particular the beauty of the human form in the bloom of health and the perfection of its athletic force.

Since the word " beauty " is liable to misunderstanding, I must briefly

in what I imply here. We apply this word to two classes of phe-
na which, whatever their ultimate connection, are distinct to our
iousness. We use it, as regards a work of art, to express our recog-
ı of its æsthetic appeal. We also use it of natural objects, in par-
r of animal and human forms, which give us a certain satisfaction.
we are well aware that we might call a Gothic sculpture of a demon,
drawing by Rembrandt of a fat and physically degraded woman,
iful in the first sense, although in both cases the objects represented
l be called repulsively ugly.

is double use of the word " beauty " propounds extremely difficult
ions in æsthetics. But we may note, as common qualities of natural
ts which we call beautiful, symmetry (as of two sides of a face) and
ırity of surfaces and contours that are uninterrupted by sudden or
ected changes of direction, surfaces that are inviting to the eye
ps because of the promise of pleasure to the sense of touch.[1]

e peculiarity of Greek art lies in this, that the Greeks endeavoured
te the two ideas in one. They thought that art should concern itself
t exclusively with objects of natural beauty, and that in his render-
these the artist should endeavour by selection to heighten those
ies which arouse the notion of beauty in natural objects. So great
een the prestige of Greek civilization in philosophy and literature,
perfect within its narrow limits was the sculpture which resulted
this theory, that it has dominated æsthetic speculation almost from
ay to the present time, and even to-day confusion between the two
s not uncommon. We frequently hear artists reproached for treating
atural appearances, although the art of the intervening centuries can
countless masterpieces to prove the irrelevance of such criticism.
cannot doubt that the Greeks had a natural sensibility to visible
, which was nearly if not quite as supreme as their intellectual power
heir poetic feeling. The remains of their architecture, with its un-
sed subtlety and perfection of proportional relation are a sufficient
of this. In the art of sculpture (and probably of painting) this sen-
was concentrated almost exclusively upon the naked human form
greatest physical perfection. And in this direction they established
has become the recognized standard of physical beauty for European
In this connection we must remember that, in spite of the bitter
which raged between the various city-states of Greece, there was
stitution in which all participated and that was the Olympic games.
eece united to watch naked youths from various states competing
supreme power of victory, an honour which was sometimes cele-
by the erection of the victor's statue in the sacred enclosure.
religion became then instinctively associated with something like
hip of the perfectly developed human body. The gods themselves
conceived as merely exceptionally perfect specimens of human
, of different ages and bodily types. For types such as Zeus and
ios, which could not be expressed by the figure of the youthful
, they invented a type in which age had brought no physical decay,
ch wisdom and power were expressed by an extreme gravity of

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[1] s possible that these characteristics of natural beauty make their appeal
sference from the sexual attraction of the feminine form.

bearing and facial aspect. This gave rise to an idea of nobility in art which has frequently had very unfortunate consequences.

The main theme of Greek art was the body of the young athlete, man or woman, and the artist's concentration on this produced both good and bad results. To the good we must put such a comprehension of the plastic forms of the human figure as no other art had approached, and which has remained one of the chief characteristics of European art ever since the recovery of Greek conceptions in the Renaissance. This has great advantages both for painting and sculpture, since the human figure not only provides a great variety of plastic sequences for æsthetic interpretation, but these sequences are instinctively and easily intelligible to us. On the other hand, this predominance of the human figure tends to limit and distort our vision of external nature as a whole. In particular, it has prevented European artists from acquiring the intimate understanding of animal forms which some Eastern arts have attained, and has delayed, though not prevented, our understanding of landscape and vegetable forms. European art under Greek influence has tended to become exaggeratedly anthropocentric.

Even in the plastic rendering of the human form, however, the narrowness of the Greek attitude has not been an unmitigated good. The athlete is trained with a view to the perfect execution of certain hard physical feats. He learns to repress all movements which are superfluous to that end. His body is either in a state of alert repose or in action. Neither his face nor his body is likely to be particularly expressive of complicated emotional states, or at least the artist, whose prime concern is with the physical perfection of his body, will tend to neglect such expressive movements. As a matter of fact Greek sculptors generally chose, as being most expressive of beauty, states of repose or very slight and simple movements. Indeed a whole æsthetic doctrine has been constructed on this habit—the doctrine, namely, that sculpture should always be static. Whenever the Greek artists of what is regarded as the great period endeavoured to render movement under stress of emotion, as in the Niobe group, they showed how little they understood movement as expressive of psychological states. Greek sculpture remains curiously external and descriptive. The sculptor gives us a marvellously accurate description of every part of the body and puts them together with a slowly acquired and firmly grasped sense of how they are related in certain poses, but except in one or two of the greatest artists, such as Myron and Pheidias and again in later Hellenistic art, we miss that intimate sense of the inner life of the figure through which alone the last expressive perfection of vital rhythm can be attained.

This lack of instinctive feeling for vital rhythms comes out particularly in the treatment of animal forms. The Greeks tended to read these like everything else from their anthropocentric position. They observed the external forms of animals accurately enough, but they could not enter into their life as some more primitive peoples have. We can see the contrast of these two methods of plastic interpretation clearly enough in those works found on the Sea of Azov where Greek and Scythian artists worked side by side and copied each other.

In later Greek sculpture of the Hellenistic period the athletic male e no longer predominated, a greater interest was shown in the female e, and poses expressive of more varied mental states were discov- . In spite of a great deal more sentimentality and bad taste in the art is period, there is in the best work (particularly in some female s) a finer sense of plastic rhythms and a more sensitive modelling of ces than in the works of previous periods. The prevailing idea that 350 B.C. Greek art is decadent is justified only in so far as much of the is inspired by trivial and vulgar motives. The best work cannot under this condemnation, and the acceptance of movement as an ession of emotional states actually provided a new fund of richer and perfectly harmonized plastic relations. The cause of the trivial, vulgar of this period must be looked for in the social conditions of the day. ander's conquests and the resulting Greek domination of the East ght about a vastly freer intercourse around the shores of the Eastern iterranean, and gave rise to a flourishing industrial and trading civ- ion which continued under the Roman Empire. The social ambience ese wealthy trade centres and of Rome itself must have resembled any ways the social patterns of our own time. The phenomenon of arity made its appearance. Probably this must occur whenever a nercial middle class gets rapidly richer and desires to force its way aristocratic circles. Under such circumstances works of art have ys been used as weapons in the social struggle for predominance. the new aspirants to social eminence are generally people of crude ls and coarse untrained sensibility, and they set up a demand for s of art which correspond to their low mental and emotional level. ial or banal situations of everyday life, which can be immediately ehended because of their familiarity, treated with exaggerated em- is on their pathetic, sentimental or comic possibilities and on an ex- e verisimilitude of details, best fulfil this demand.

nder these conditions works of art become divisible into two distinct es—one in which for some reason or another the artist can express genuine æsthetic impulses, the other in which the artist uses his ical skill to gratify a public incapable of responding to æsthetic als.

ich was the situation roughly speaking from 200 B.C. to A.D. 200. As now, a similar situation began to appear towards the end of the eenth century and has persisted more or less to our own day, and similarity of social pattern has gone with a still more marked division orks of art into æsthetic and commercial groups. But whereas this tion produced in modern times a great creative effort among the artists, there was a special reason why in the ancient world it was ively barren. When the Romans conquered Greece in the second ıry B.C., they carried off innumerable masterpieces of Greek sculp- and set them up in Rome, obeying in this the general law that works t have the highest prestige value, and this in spite of their own pro- d contempt for artists. These masterpieces aroused such enthusiasm ıg the more cultured Romans, that the best artists of the time (gen- Greek immigrants) were employed in making copies of these Greek ıals or in giving to Roman official portraits something of the air of k heroic figures. Thus the more gifted artists found little scope for original creative work and were forced to create fundamentally insincere work. This attitude caused the production during the first century A.D. of a type of art called archaistic, in which the artist endeavoured to recapture the forms of a more ancient style. Inevitably, however, the more sophisticated and complex emotional feeling of the day conflicted with the formal qualities of the work which had been created in response to a very different mental attitude, so that whatever the superficial charm of such works may be, their fundamental insincerity cannot be hidden.

Hitherto nothing has been said about painting in Greek art. For the early and middle periods (the fifth and fourth centuries) we have no remains except the paintings on vases, which are only in contours round flat colours. But it is thought that some of these reflect the designs of the great wall paintings of which Greek and Latin writers speak. It must be admitted that the drawing on Greek vases shows the limitations of Greek art more clearly than its merits.[1] The line tends to an almost flaccid even elegance of movement. Even more than in Greek sculpture we feel the want of any controlling sense of vital rhythm in the rendering of movement, and in the composition we find very markedly a defect which may also be seen in some of the reliefs (even in the metopes of the Parthenon), namely the want of real rhythmic correlation of the figures one with another. Finally, there is but little feeling for the relation of the forms with the pot which they decorate.

The essential difference between painting and sculpture lies not in the rendering of individual figures, but in their relation to an imagined space. What we learn from literary sources, and from the pictures of Hellenistic and Roman times which have survived, shows us that the Greeks had progressed much further than the Egyptians in discovering the fundamental principles of painting. They had certainly some idea of the laws of perspective and they had studied the foreshortening of individual figures, but it is doubtful whether the development of the picture space had ever proceeded far. The best examples, like the battle of Alexander and Darius and the Aldobrandini marriage, show the figures disposed across a narrow stage. In some of the decorative paintings of Pompeii, however, as also in some of the later Hellenistic reliefs, we find a rather capricious suggestion of wider landscape horizons. But these never go beyond a sketchy suggestion of space relations in a manner similar to that of certain Chinese and Japanese decorative paintings.

It has been necessary to dwell at some length on the course of Greek art because of its immense influence on the whole of subsequent European art. The Greeks fixed for Europe the norm of the human figure and set a standard of realism in its rendering which European artists have never quite lost sight of. It has also inspired the conception of idealized form, implying an emphasis on whatever suggests nobility. To this day our portrait statues, and often our painted portraits, tend to become feeble and unconvincing because of this *damnosa hæreditas*.

We have treated of Roman art hitherto purely as a relatively unimportant appendix to Hellenistic art, but in reality there was another strain

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[1] The forms of the pots show that mechanical perfection and regularity of curvature were aimed at, rather than the direct expression of plastic rhythm such as we find in the best Chinese and Persian work.

nfluence derived from the Etruscans. This people, who had arrived
uscany (probably from Asia Minor) long before the rise of the Roman
, had brought with them the high level of culture and the technical
tions of the Eastern Mediterranean. They practised a decorative art
hich Mesopotamian and Egyptian influences were combined. From
sixth century on, the Etruscans imported quantities of Greek works
t and adopted Greek ideas in their own work. Even in their imitative
ks there emerges something of a cruder, more restless vitality, with
ndency to emphasize character. This distinctive and original quality
es out particularly in their terra cotta portraits. It was the custom to
ray husband and wife lying together on a couch upon the lid of the
ly tombs. In these there is an unmistakable sharpness of accent, an
nctive sense of what marks individual character, which we scarcely
elsewhere in ancient art, which is indeed particularly foreign to
Greek, who had on the one hand his tendency to a generalized type
eauty and on the other a power of purely external observation. The
t of character in Etruscan sculpture is not dependent on a detailed
sm, but is the result of an instinctive feeling. It has often been re-
ked by critics that this specific tendency of Etruscan art seems like
germ of those qualities which flowered so magnificently in Italian art
uries later. Whether this realistic trend of Etruscan art is due to
Etruscans themselves or to something that emerged from the in-
nous Italic peoples over whom they ruled, as has been suggested,
ains doubtful, but in any case we note here a tendency already present
talian soil which suggests a possible origin for those qualities in later
an art that could never have been derived from the Græco-Roman
ure it inherited. This vivid Etruscan realism probably also affected
an art in that form which the essentially " Philistine " Roman patron
eciated best, namely the portrait statue. It was in this branch that
an art showed a certain originality and independence. It can hardly
aid, however, that the Romans ever succeeded in giving to the like-
that imaginative and æsthetic significance with which later art has
sted the portrait, both in painting and sculpture.

SCYTHIAN AND CHINESE

wo other centres of culture in the ancient world remain to be con-
ered. One belongs to the region of the Steppes of Central Asia, the
r to China. We know very little about the culture of the Central
n Steppes in the early periods, but among the nomad tribes that
dered over it the Scythians are of extraordinary importance for our
y, because they created a specific style of sculpted, or rather moulded
f in metal which has been called the " animal style." It is probable
this style owes its origins to a culture that emerged from the neolithic
e with the discovery of copper somewhere before 3000 B.C. The
er vases from Maikop in the region just North of the Caucasus are
ably contemporary with early Sumerian art, with which they have
e analogy, but they already show a peculiarly intimate understanding
nimal forms. True Scythian art however dates, as far as we know,
a later period, probably from the eighth or seventh century B.C.,

and continued till the early centuries of our era. Scythian art is manifested to us almost exclusively in the moulded bronze and gold ornaments and weapons which the nomad hunters and warriors carried on their persons and had buried with them in their tombs. It has a very wide range, extending from China to the North of Russia, and the motives used by the artists vary with the fauna of the districts where they worked. But all their art is based on animal forms which are often combined together in the strangest way, as for instance when one animal's body is made up out of the forms of a number of other animals, or the tail of one animal ends in the head of another. The favourite theme is either a fight between animals, or a horse dragged down and devoured by wolves or other carnivores.

Few people have ever found such striking interpretation of animal forms as these Scythians; none has had so intimate a feeling for the rhythms of the living animal; none has known as they did how to reduce the complexity of natural form to so simple and yet vital a statement. Their art is the exact antithesis to a descriptive art. It was not by cataloguing the observable facts about an animal that they proceeded, but by some intimate intuition of what might be called the dominant rhythmic character of the beast. In this way they were able to confer the semblance of life upon forms which sometimes scarcely define the animal at all, so far has the process of plastic synthesis and abbreviation been carried. No doubt the social organization of these people was of the simplest kind, and it is not to be wondered at that their art lacks the organized and combined effort which created vast and enduring monuments in the great empires of Egypt and Mesopotamia, but it never suffered from the social restraints which checked, even if they did not extinguish, the artists' æsthetic impulses. The art of the Scythians has the purity of æsthetic purpose that we find in the work of primitive peoples. A Scythian plaque is entirely permeated with the expressive quality of its creator's sensibility. Its forms emerge freely from that and obey no conventional control.

In contrast to the primitive conditions and incapacity for co-ordinated endeavour which mark Scythian art production, Chinese art grew up in a complex and organized social system. This system must be regarded indeed as, in its main outlines, one of the least imperfect social adjustments of the conflicting desires of individuals that have ever been devised, if we may judge from the fact that it has had some kind of continuity of tradition from the third millennium before Christ (and perhaps even from Neolithic times) down to our own day, a record which surpasses that of Egypt itself. But this very continuity is in part responsible for the fact that no great monumental or communal works of early periods have survived, nothing in the least comparable to the temple, tomb, and palace arts of Egypt and Mesopotamia, since these early monuments have been continually replaced by succeeding generations. Moreover, in China, until the foundation of the empire in 221 B.C., power was in the hands of a number of feudal princes who were too much occupied by mutual warfare to accomplish any vast works. In any case, what is left to us of the works of this period consists almost entirely of bronze sacrificial vessels, some pottery and minor works of art. But these are of such a distinct acter that we cannot omit them from our study. We have seen that for most part the art of the ancient empires was controlled by its non-etic social functions; that imposing scale and perfection of finish e aimed at, and that only here and there could the artist express even atively his individual sensibility. China is the only great, early, highly nized civilization in which we feel that the artist's sensibility comes into play. When we look at the bronzes of the Chou period, we feel however rigidly the artist may have been bound to observe certain s in order to conform to the principles of magic and ritual, within e limits he had freedom. Each one of these vessels appears as a new overy of plastic harmonies of the most surprising kind. The propor-s of each part with regard to the whole, the exact curve of the galb, rofile, the projection of the moulded ornamentation, all have been felt an intense imaginative conviction. Moreover, however marvellous technical skill required for such elaborate metal work, this is never sted on, nothing is sacrificed to mere finish; the idea of luxury is nt. Chou bronzes are in fact for the most part pure works of art. eover, wherever animal forms enter into the design, as they often do, notice that the Chinese artist has retained, perhaps from more primi-times, that peculiar instinctive grasp of vital rhythm which seems ften to disappear from a civilized and self-conscious art. The little is left to us of true sculpture—mostly animal forms—bears out what id above, and these remain indeed among the most perfect works of r kind that we know of.

ith the unification of China under the Han Emperors not only was e a great increase of wealth, but both wealth and power were more ralized, and the social system, with its new slave class, must have roximated more to the patterns of other ancient empires. And, in , we do find at this period a certain number of works in which the ct of luxury is attained by a display of extreme technical skill and oration at the expense of any clear æsthetic purpose. But whereas where such works are the rule, in China they are the exception. The pture of this time shows the same synthetic grasp of formal structure he earlier works and a strong feeling for subtle, non-accented plastic hms.

ince the tradition of Chinese art has never suffered any complete ure, it will be convenient here to continue it into later times. In the century of our era the growth of Buddhism had a profound influence Chinese art. It brought with it from Central Asia types of the hybrid veen late Greek and Hindu art which had arisen in N.W. India and ria. But though the actual types and poses of Buddhist imagery were pted from Indo-Greek originals, they were translated at once by nese sculptors into their own plastic idiom. This new imagery, how-, demanded a shift of the sculptor's attention from animal to human ns, since his work was dedicated to the glorification of Buddha and holy beings by whom he was surrounded. It was necessary to discover ns expressive of an idealized humanity but idealized in one direction, ely that of the serenity attained by pure contemplation and detach-t from the world of illusion. Among the innumerable works of dhist sculpture, which were produced in the sixth and succeeding centuries (vast caves were filled with figures carved in niches in the rock), are some which succeed in expressing such an idealized humanity in forms of supreme beauty and often, with a view to greater impressiveness, on a colossal scale. But the subordination of the sculptor's powers to a strictly religious end was not entirely beneficent. For one thing Buddhist imagery, as practised in China, was for the most part extremely limited. It proposed only slight variations on a single type of face and bodily character. Nor did Chinese sculptors take much advantage of those Buddhist legends which might have given opportunities for action in the figure, with all the varied possibilities for rhythm which that suggested to European artists. More serious still for art was the tendency to regard sacred images as having magical properties, so that the mere repetition of sacred figures had a value. It sufficed for this end that the marks of holiness of the figure should be recognizable. The result was an immense production of merely journeyman sculpture without any claim to æsthetic value. We have here again a case of the pursuit of a biological end supplanting the spiritual æsthetic activity.

Painting, as well as sculpture, was pressed into the service of Buddhist art, and some of the finest existing examples of Chinese paintings are frescos which adorned Buddhist temples. But painting was not confined to Buddhist or other religious motives. Apart from fresco painting on temple and palace walls, the Chinese adopted as their chief medium water-colour on silk. They never developed a technique of tempera and oil painting, such as the Europeans did. This choice probably was no mere accident in either case, but corresponded to fundamental differences of feeling in Eastern and Western culture. We have seen that Greek art was influenced, in many ways unfortunately, by the artist's desire to realize and describe accurately the whole anatomy of the human figure. His æsthetic reaction to visible nature was accompanied by a vivid curiosity, a desire to know all the facts as well as to feel the significance of their appearance. And this we may assume was an inevitable result of the free intellectual activity of a people who, by their special aptitude for doubt and curiosity, bestowed on mankind the gift of science. The Greek artist thus continually modified his synthesis by analytical enquiry and scientific observation, and he learned thereby to construct images which were equally complete in every part, which did not merely suggest the real objects they represented but described them accurately and with no omissions. The texture of their imagery was solid from end to end ; there were no gaps. This was true at least of their sculptured renderings of the human figure and, so far as we can judge, was partly true also of the relations of the figures in space as realized in their painting. In any case it became true of later European art. Apparently no other culture but that of Europe has endeavoured, in its painting and sculpture, to create this perfectly consistent texture in its imagery. That is to say, to create imagery in which all the relations of every part cohere together not only according to æsthetic needs but also according to the laws by which the appearance of real objects to the eye is governed. The Chinese, though their attitude to life has generally been more rationalistic, if not more matter of fact, than has frequently been the case in Europe, have never had quite the European curiosity, have never, in any case, developed our scientific ude. They have never, therefore, felt our impulse to give to their gery the same continuity and solidity of texture. They have been ent to mark those parts of the total appearances of nature which ned to them significant, relying on the spectator not even to ask for rmation as to the rest. They have never been either so analytic or so riptive as the Europeans.

or their purposes, then, water-colour on silk was an ideal medium. A ke of opaque oil paint upon a canvas gives to the eye a single positive ement of a particular tone and colour, there is nothing uncertain about out a wash of water-colour on silk is varied at every point by the dif-nt thicknesses of liquid which have dried or been absorbed by the silk rious points. It does not make any one positive statement, but suggests possibility of different interpretations. The painter in oil is committed, he positive statement contained in his first brush stroke, to complete texture of his image by covering his canvas. The water-colourist, par-arly if working on silk, can leave large surfaces of untouched silk veen the various parts of the total vision to which he wishes to call attention.

nother result of Chinese technique in painting must be noticed. Oil t, having a certain viscosity, tends to cause a drag on the artist's ure in making a touch, whilst liquid water-colour leaves the gesture ly free. The result is that what is called, by analogy, the " hand-ing " of Chinese pictures is more clearly evident than it is in most opean painting. This handwriting, which records the habitual and inant unconscious reactions of the artist, supplies one of the most ct expressions of his sensibility. In his main design an artist expresses deliberately chosen and conscious rhythmic idea ; in his handwriting carries this out with innumerable subtle inflections and variations ch, in the case of a felicitous choice of idea, harmonize with and en- the main theme. Great as the importance of " hand-writing " always been, and must be, in the art of painting, it has nowhere been re-nized as clearly and exploited as deliberately as by Chinese artists. eed their appreciation of linear rhythm has led them to regard calli-hy (handwriting in its literal sense) as one of the fine arts. A fine imen of the handwriting of a master is treasured as much as a master-e of painting, and this attitude has constantly reacted in turn upon ting itself. This keen appreciation of handwriting has not been with-its dangers to Chinese art, as we shall see later, and its effects would been greater had not Chinese artists and writers on art insisted from times (fifth century A.D.) on the need for the rhythm to conform to vital rhythms of living things. As Mr. Binyon has pointed out,[1] this informs even the less intelligent talk about art. In Europe, from the when Zeuxis's bunch of grapes caused birds to peck at them, the ptiveness of a picture has been the source of much idle admiration. China the corresponding story is of how, as a great artist put the touch to a dragon which he was painting on a temple wall, it soared hrough the roof and left the wall empty. This attitude shows that the ng intuitive feeling for vital rhythms, which we noted from the first in their sculpture, not only dominated their painting, but that its importance was clearly recognized.

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[1] Laurence Binyon : *Painting in the Far East* (1923).

Although painting was probably a completely self-conscious and elaborated art already in Han times, if not before—it is almost impossible to find anything that we can call primitive in Chinese art—it is probable that the power to dispose figures within a consistently imagined picture space was not fully attained until the great classic period of Chinese painting in T'ang times (618–905). Landscape painting (in which the construction of the picture space is of prime importance) was already recognized not only as a possible form of art but as one of the most important of all expressions of the spiritual life, while Europe, with its intense anthropocentric bias, had to wait until the seventeenth century to arrive at a similar conception.

The Chinese feeling for landscape and particularly for what we call romantic landscape, mountains and torrents, has been well analysed by Mr. Waley.[1] He shows how, with the over-elaborate machinery of the Chinese bureaucracy—a bureaucracy, moreover, composed of the most highly educated and cultured men of all classes—the desire to escape from the pressure of social life became a frequent obsession of more sensitive natures. They longed to live the life of the hermit, " to live free and fearless in the isolation of the hills." This impulse had nothing of the ascetic-religious impulse which drove the early Christians into the Thebaid. It was rather the ideal of complete self-realization by release from social pressure. Those, too, who never even attempted this flight from society, adored " mountains and torrents as symbols of escape," and for them landscape paintings, in which this aspect of nature was emphasized, became a source of spiritual satisfaction.

Chinese painting, then, acquired, at a far earlier date than European, the practice of vast space constructions. These artists, however, never seem to have worked out the laws of perspective with the completeness of later European painting. On the other hand they were impelled, by their special feeling for the overtones of nature, to study atmospheric effects of a kind which European art overlooked, until the nineteenth century, as being too elusive to admit into the more rigid context of their designs.

Nor was landscape the only aspect of painting in which the Chinese anticipated by many centuries the course of European art. Already in the T'ang period they created *genre* pieces, in which they expressed the subtlest spiritual overtones of a highly refined social life. Such, for instance, is the celebrated painting called " Listening to Music " by Chou Fang of the early ninth century. Here the whole design depends on the relative positions of the figures to each other in the vaguely suggested picture space, and on the significance of their poses. It succeeds in arousing a mood of *recueillement*[2] not unlike that which emanates from some of Giorgione's compositions. But whereas Giorgione expresses this mood through a complete plastic realization, the Chinese painter attains a nilar spiritual end mainly by the subtle perfection of his divisions of picture surface, plastic relief and space recession being but faintly ggested.

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[1] Arthur Waley: *An Introduction to the Study of Chinese Painting* (1923).

[2] This word, for which old English writers frankly used *recollection*, implies the ingathering of the personality for a contemplative attitude. We might, perhaps, use the word *re-collection.*

With comparatively rare exceptions, Chinese art seems to have been direct outcome of æsthetic impulses aiming at pure spiritual satisfac- ns. A certain proportion of the minor works of art bear the impress of desire for luxury and have the inexpressive shop-finish which results m that, but, in the main, art was not captured by society for biological ds. It was a free art. The Chinese are perhaps the only people who have nstantly recognized the spiritual function of art, in a way that has only ppened occasionally elsewhere.

And yet we have only to look at the general level of nineteenth century inese art to recognize that the Chinese tradition has suffered a process decay, and has tended to sacrifice to trivial amusement or idle curiosity e Chinese “ curio ” and “ Chinoiseries ” are evidence) the more in- se and important spiritual states to which their great art had given pression in earlier times. When we study the causes of a similar degrada- n in European art, we shall find that a trivial pleasure in mere veri- nilitude has been a large factor, but in China, where complete, “ pho- graphic ” imagery was never attained, the causes must be sought else- ere. They lie, in part, in that very vivid consciousness of the spiritual wer of æsthetic creation. This led to an unintelligent reverence not ly for the artist’s creative power but for all that is accessory to that. In passion for collecting, which such a highly cultured society developed, ological forces found a more devious access to the realm of art. The rship of rarity and antiquity, and the consequent prestige of those who d acquired rare antique pieces, led to a brisk trade in forgery and pas- he, to the deliberate imitation of ancient models and the choking of thetic feeling by a mass of pedantic learning. Besides this, we must note ill effects upon painting of a perfectly genuine bias towards a literary derstanding of the art. This induced a desire on the artist’s part to derline the poetical overtones of visual form and led, from Sung times , to an almost total indifference to plastic values and to an exaggeration the scenically impressive aspects of nature.

JAPANESE ART

All that has been suggested here to explain the decay of what was one the greatest and most consistent æsthetic traditions in the world is e, in a greater degree, of Japan. Working, as the Japanese did, under influence of an indiscriminate admiration of their Chinese masters, the dantry and falsification which connoisseurship induces was a constant to genuine æsthetic expression, and we find, alongside of the vulgar e of mere technical skill and shop-finish, a curious inverse pheno- non. The connoisseur is quick enough to see the vulgarity of shop- ish and to recognize the value of those irregularities of texture which the result of the artist’s sensibility. But this led him to an incon- erate admiration for works of art in which these qualities were de- erately simulated. Many Japanese works of art were made by extremely lled craftsmen, consciously giving an air of rough or primitive crafts- nship to their creations. This sentimental insincerity has been the bane of Japanese art. We are of course familiar with this phenomenon in modern Europe.[1] It appears to arise as an inevitable commercial exploitation of the recognition on the part of any society of the importance of æsthetic feeling.

But whilst this pedantic æstheticism and its consequent insincerity of sentiment is the most marked and distinctive characteristic of Japanese art, even from early times, it is impossible to deny the marked aptitude of the Japanese people for artistic creation. One cannot doubt, indeed, that they were not only capable of producing a great art, but had an intense will to such production, if only they could have readjusted their sentimental attitude. As it is, some of the sculptures of the ninth century retain much of the impressiveness of the T'ang originals from which they derive, with the addition of a certain fragile elegance and subtlety which are distinctly Japanese. Again in the sixteenth century Matabei created a *genre* style which expresses a personal and original outlook on life, nor can we deny genius, though of a vulgar kind, to Korin. We see here, however, the inevitable counter-effect of that æsthetic preciosity and pedantry which beset the Japanese, namely that when an artist, brought up in such an artistic ambience, endeavours to rely on his own visual experiences, he finds himself without any guidance whatever, and almost inevitably falls back either on a trivial and unintelligent imitation of nature or on a crude romantic or melodramatic emphasis.

But perhaps the most interesting phase of Japanese art was that which, in the eighteenth and early nineteenth centuries, grew up spontaneously in a quite popular and unlearned ambience. This took the form of cheap coloured woodcut prints of scenes of popular life, of a comic, pathetic or erotic character. This art, which was entirely disregarded by the cultured classes, and was first appreciated by European connoisseurs, has, at times, just that vital inspiration, that direct contact with experience, in which Japanese art had hitherto been almost entirely lacking. Though the most celebrated of those artists, Hokusai, is tainted with a too conscious and vulgar virtuosity, one or two others, and particularly Utamaro, attained to a really expressive beauty of design and linear rhythm. It is a noteworthy curiosity that some of his pornographic prints are genuine works of art. It is curious, because in almost all other periods and countries we notice that a preoccupation with this particular feeling has been disastrous to the æsthetic quality of the resultant imagery. This observation, which has almost universal validity, is indeed quite in keeping with what we know of the relation of the emotions of real life to the emotional content of works of art. For whilst, on the one hand, the whole history of art shows that art is nourished upon the actual emotional life of the artist, and springs, at least in part, from his desire to realize that more fully by expression, on the other hand we observe that it is only when the artist can stand apart from his own personal feeling and can view it with a certain detachment, as part of a greater whole, that the expression attains the unity and organic coherence of a great work of art, and we may well suppose that the emotion of physical desire is too physiological to be amenable easily to this contemplative detachment. Certain it is,

[1] The mechanical battering of machine-spun silver and copper vessels to imitate the surface of hand-made objects is a common example.

any case, that pornographic imagery which is also æsthetically uable is extremely rare.

Like the Japanese the Coreans derived their art from the Chinese, but ir temperamental reaction was very different. With less creative energy, ir interpretation of the Chinese tradition is more cautious and refined, h none of the sometimes vulgar emphasis of the Japanese.

INDIAN ART

There is no art more singular than the Indian. It covers a vast area and , though there are local and temporal modifications, the specific lities of the style are unmistakable wherever it has penetrated, from Afghan frontier to Cambodia and Java. It is one of the most original l self-contained arts of which we know, proceeding upon principles ich distinguish it in some ways from all other known arts. The suring monuments of Indian art begin at a relatively late date, *viz*., third tury B.C., and though in this and in the subsequent period foreign—sian and Græco-Roman—influences are apparent, it developed almost nediately that specific quality which was to distinguish it throughout. re than any other art, Indian seems to have been self-determined, to the pure expression of the specific sensibility of its people. For it is in many ways one of the purest of all arts belonging to a complex and hly organized civilization. It is probable that all of these characteristics ive from the Indian attitude to religion, for this art is more entirely nd up with religious mythology than any other. Whereas in the early pires religion is an adjunct of the State, all art, even that specifically deated to the Gods, tends to become a field for State propaganda and licity and to have the impurity of official art. But in India religious sentint transcended the motive of the State, and the splendour of the tems was a genuine offering to the God, not a means to heighten the royal stige. Under such conditions we should expect to find that Indian art l surpassed all others, since, as we have seen, the artist's sensibility has ely been so free from biological interference as in India. But here nes in the fact that Indian sensibility differs so profoundly from not y our own but almost all other sensibilities as to embarrass our judgnt and check our æsthetic response. In almost all other arts the unity ny complex whole is attained by what we may call the architectonic hod, since it is a method most clearly seen in architecture. It depends n the systematic subordination of parts to one another proceeding in cessive units of design. Thus the ornamental details of, say, an acanthus are subordinated to the conception of the capital as a whole unit. e shape, size and proportions of the capital are subordinated to the of the column as a whole. The columns and their interspaces are ordinate to the idea of the story as a whole, and each story depends on nature of the façade as a whole, and so on. And this principle tends to ern all great sculptural or pictorial monuments. But it appears to be rcely demanded by Indian æsthetic feeling. It would be an exaggera to say that this demand is altogether lacking, but it exercises very e control. The Indian artist felt free to weave an unending texture of umerable interlacing plastic forms over the surfaces of temples and

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rock-cut chapels. The tropical exuberance of his fantastic and sometimes monstrous inventions seems unchecked even by physical difficulties. No other people has ever dreamed of sculpting such great temples out of the solid rock as he has. Indeed, Indian architecture proceeds, not as ours, according to the principles of construction; it is rather conceived as an object cut out of a solid material as an ivory figure might be. For undoubtedly the Indian artists had an extraordinarily developed plastic sense. Now in other arts, particularly in European, we find that a strong plastic feeling generally goes with firm architectonic control. In general those schools or periods wherein plastic feeling has been weak have tended to picturesque exuberance and decorative colour effects. But in India it is the reverse, and the plastic sense has been developed almost at the expense of architectonic control. Indian sculpture indeed shows an extraordinary grasp of three-dimensional form. In the West sculptors were continually obsessed by the full-face aspect of the figure, as we see in most early reliefs. It was only little by little that they ceased to feel the control of the four facets of the rectangular block out of which a figure was carved ; only by degrees that they could allow the limbs of a figure to move freely in every direction. But the Indians who could carve a whole temple out of a rock face felt no such constraint, and even when their mythology conceived of Gods with many arms and heads dancing they were able more or less successfully to solve the extravagant plastic problem such an idea presents. The nude human figure plays as great a rôle in Indian as in Greek art, but the sculptor's attitude is strangely contrasted. All art is inevitably rooted in sensuality, but the question of how that is elaborated by social habits, by philosophy and by religion, what overtones it emits, is decisive for the arts. Now Indian sensuality seems less transmuted by reflection than that of the West ; it is at once religious and predominantly erotic. Whereas the Greeks were moved mainly by the athletic perfection of the nude figure, the Indians felt most the female figure and the seductive charm of its free flexibility of movement. The result is a certain languid flaccidity in the dominant rhythms of Indian sculpture. And as these rhythms are interwoven in unbroken sequence, with no clear architectonic control, they rarely command complete æsthetic acquiescence to the Western eye. There are, of course, many exceptions to such a general estimate. At Ellora, for instance, the whole design of the rock-cut temple has a satisfying architectonic unity, and the composition and rhythmic idea of many of the reliefs is easily apprehended, whilst individual figures are often modelled with the utmost sensitiveness and delicacy of feeling. At Anuradhapura, in Ceylon, a greater restraint in the rhythm gives to some figures singular impressiveness. Again at Borobadur the Javanese sculptors invented an extremely picturesque style of narrative relief which is as lucid in its organic relations and appropriate in expression as the best of such reliefs elsewhere.

It is probable that painting was no less important than sculpture during the great periods of creative activity, but very little has survived. The frescoes at Ajanta show a narrative style of great freedom, with much of the same easy command of varied poses as the sculpture, but a relatively feeble and capricious sense of the construction of an ideated space. Judging from fragmentary reproductions, one may surmise t the frescos at Bagh show a much nearer approach to complete torial design as understood in Europe and a surprising power of rening difficult aspects of vision.

ndian painting took a fresh start at the Moghul Court, basing itself on sian miniatures. This decorative art is of no great interest, but the put school developed a more authentic native style, which is howr mainly decorative and descriptive, with little plastic feeling and a dency to literalism in the details.

THE ART OF THE DARK AGES

Gradually, as the elaborate bureaucratic organization of the Roman pire went to pieces under the constant pressure of the wanderings of barbaric tribes, Northern and Western Europe reverted to a primitive ture. Wealth became insufficient for elaborate artistic creations, and arts were reduced to the ornamentation of weapons and rough ellery. These took the form of geometrical patterns filled in with oured stones, glass and enamel, in a style of technique and design ich derived from those practised by the Sarmatians in Southern ssia and the Caucasus. This style appears to have spread north and t and thence over Gaul and Britain. The Sarmatians were akin to the thians, but their art had little of the rare plastic sensibility of that ple. The style of the Dark Ages in Europe is lacking in organization ; s vague, incoherent and rambling. Though it is rough and barbaric, hows none of the delicate sensibility to form which we have noted in art of primitive peoples like the Polynesians and Negroes. There is curious exception to this relative insignificance of the art of the Dark es, namely the crosses erected in Northumberland and on the Scottish der during the seventh century. These belong to an altogether higher ture, and suggest connections with South-Eastern Europe. Painting tinued in the form of illuminated MSS. executed in monasteries, and either, like the Irish, based on the Sarmatian style or, in Central ope, lived on distorted reminiscences of Classical art.

BYZANTINE AND SASSANID ART

n the Eastern Mediterranean region, however, the situation throughthese centuries was very different. Here the Empire held out and ntained something of the tradition of Classical culture. But, though ch of the organization remained, the spirit underwent a profound nge, and this change expressed itself in a new art which gradually erged from the Classical tradition. It was this new art, which grew up he countries around the eastern end of the Mediterranean, that formed basis of what was destined to become the general style of European By the twelfth century, if not earlier, a consistent and fairly uniform e of sculptural and pictorial iconography had become established oughout Europe. The change was from the exhausted, descriptive, uralistic art of the later Empire to an art of much less accomplishnt, as far as knowledge of nature is concerned, but of greater expressive ver and far richer and more varied decorative effect. The question of where and how this change was effected has been fiercely debated. Some have sought for the cradle of the new art in the East, others have claimed it as an evolution within the Classical tradition, and even believed that Rome was the centre. It can scarcely be disputed, however, that wherever the first germ of the new ideas emerged—and it may have emerged simultaneously in more than one centre—by far the most striking and evident examples of the new style derive from Egypt, Syria, Sassanid Persia and Byzantium.

The essentially external and ritualistic Paganism which remained the official religion of the Roman Empire was adequately expressed by official Hellenistic art. But long before Christianity appeared Paganism had been deeply undermined by various imported mystical religions. In particular, the Egyptian preoccupation with the life after death had, for some time before the birth of Christ, produced a profound influence through the worship of Isis which, like Christianity, assured the believer of victory over death and the possibility of salvation in the next life. Thus the formulæ of Hellenistic art were no longer adequate to the spiritual needs of the day. None the less Isiac, as well as, later on, Christian myths had perforce to be figured more or less in Hellenistic pictorial and sculptural idioms. In the nature of things, this could not be more than a temporary makeshift. It is doubtful whether Rome itself had enough artistic feeling ever to have found an alternative, but in the Eastern Mediterranean as well as in Byzantium itself, with its close Eastern contacts, there was the possibility of such a transformation.

And here a curious factor intervened. With the growing impoverishment and financial stress of the Empire it became increasingly difficult to maintain a high level of technical skill. In the West this merely led to more and more clumsy repetitions of Hellenistic forms, but we find a different situation in the East. In Egypt, for instance, the native Egyptian (Coptic) sculptors worked on Hellenistic models but without the technical training which Greek artists had had. Their deeply imbued æsthetic feeling, however, could not be satisfied with merely feeble imitation of the given forms. They had to produce something which, whilst within their limited technical power, yet satisfied at least their age-long decorative instincts. Since they could not carve an acanthus leaf with its natural curvature of exfoliation, they repeated the easiest part of the design—the sharp triangular serrated edges. They cut deep incisions, leaving roughly triangular projections, in a decorative scheme over the surface of the stone, and this produced a sculpture which by its richly lighted and shaded surfaces gave an effect, as it were, of colour. More and more such "coloured" effects tended to replace the plastic forms of the original. Or if the Copts sculpted Greek amorini, though they had little idea of the proportions and scarcely any of the anatomy of the human figure, they managed to give to them something of the sensual charm which underlay much of ancient Egyptian sculpture. The same is true of the painted portrait heads which were inserted into the tops of mummy cases. These start with typical Hellenistic "ennobled" realism, but rapidly lose the regularity of feature of the models and by sheer simplification, loss of modelling and reliance on outline, rather than shading, take on a new character, becoming more emphatic and inspired by an instinctive sense vitality and individual personality. It is evident that a new control over expression of psychological values through elementary forms is being ated, and is replacing the literal descriptive realism of Græco-Roman We note then that technical incompetence may, under certain con-ons, actually be favourable to æsthetic invention, although under er conditions technical power may be of the utmost service.

ome of the most striking evidences of the new idea are the great reliefs on rock faces to commemorate the glories of the Sassanid Kings, and particular their victories over their Roman invaders. Here almost all forms are those of a debased Roman tradition, but they are related to another with a new sense of the expressive possibilities of composing arge masses ; there is a new dramatic energy in the poses very distinct n the tired rhetoric of similar Roman monuments. There is a new lity in the rhythms, particularly where animal forms are concerned, in this we may suspect the survival of Scythian influence. In their al reliefs on silver bowls and jugs we find the same evidence of the dual formation of a new vividly expressive decorative style out of Roman erial. Finally, in their silk brocades this style takes on its complete ty of character.

lmost identically similar silk brocades were being executed at the e time (fifth and sixth centuries) in Byzantium and it was here, in at was still the great world centre of culture, that the new art produced greatest triumphs. Here, besides the new and magnificent architec-e, of which St. Sophia is the grandest exposition, a great style of monu-ntal wall painting (in the form of mosaic) was developed. In these ks the illusion of real relief and modelling given by light and shade, understood by Hellenistic painters, was gradually and intentionally ndoned. Organization in depth is sacrificed to a more perfect, more oratively effective organization of the flat surface of the wall. Firmly igned flat masses with clearly marked contours replace modelling. ese artists rely for their effect on the impressive ordering of the large sions of the flat surface and the decorative splendour of the colour of se divisions, and upon the new power of suggesting vital energy and sonality in the contours of their imposing figures.

aturally enough, since the Christian contempt for the body had re-ced the Greek worship of the nude athlete, it was upon the drawing of face that the Byzantine artist concentrated. It is evident from these saics that this style afforded a new power of suggesting psychological es. It was particularly in this respect that it was able to embody the rations of Christian supernaturalism, though it also, especially in earlier period, served to glorify the power of the Emperor.

his mosaic decoration of the new system of Church building was the n artistic form of the Byzantine culture. Sculpture was mostly used decorative purposes in bas reliefs of marble or ivory. In general, the ciples of plastic relief were abandoned in favour of the richer organi-on of flat surfaces.[1] In the ivories of this later period we find a tendency

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This abandonment of sculpture was also due to the iconoclastic movement ch led finally to the separation of the Eastern and Western Churches. The ts of their Mohammedan enemies that they were idolaters led the Emperors 1 726–843 to proscribe the use of images.

to an insensitive perfection of finish which betrays a non-æsthetic motive, but on the whole what surprises us most in Byzantine art is that, in the long period through which it continued, the artists' sensibility seems always to find expression. An extraordinarily just sense of proportion in the general plastic form of objects (such for instance as the silver vessels for service in the churches), an exquisite taste in the spacing of their decoration, and still more for the value of untouched surfaces, and an astounding power of expression in their rendering of figures, within the narrow limits which their methods of design imposed, are what strike us in Byzantine works of art of almost all periods down to the fall of Constantinople. This art indicates a very limited outlook upon life with little interest in nature, owing to the restrictions imposed by a rigid religious orthodoxy, but within these limits it is singularly free from the impress of non-æsthetic impulses. For all the proverbial splendour and corruption of the Byzantine court, its art is innocent of the motive of vulgar display. It is in this a striking contrast to the art of all the ancient Empires except the Chinese.

How great and surprising was the vitality of this " decadent " Empire in the arts, as well as in policy, has recently become more apparent since researches in Bulgaria and Rumania have brought to light a number of fresco paintings of the twelfth century which show a remarkable renascence. In these we find signs of a new dramatic power and a search for greater realism in the rendering of the figure, which anticipated and probably influenced the beginnings of the far greater Italian renascence in the fourteenth century.

RUSSIAN ART

Byzantine painters of the twelfth century also found their way into Russia, where some of their masterpieces both in fresco and panel painting are still preserved. These artists were the originators of the native Russian School. This school is one of the most curious in the history of art in that it adhered with an extraordinary conservatism to the principles of its earliest tradition, so that even nineteenth century ikons remain essentially Byzantine in style. Whilst the rest of Europe was exploring all the possibilities for pictorial design which the infinite variety of nature reveals, the Russians continued to paint almost entirely without reference to their visual experience. Such changes as occurred were in the nature of mere variations of colour and tone harmonies within the fixed traditional formula of composition and figure-drawing. None the less, in the fifteenth century a few artists, of whom Rublev is the best-known, found means to express an individual feeling within these prescribed limits. This strange fixity of a pictorial tradition is comparable to that of the sculptural tradition of Egypt and like it is due to priestly predominance, for in Russia the art of painting remained until comparatively modern times a purely religious affair. This rigid conservatism of hieratic art is of course in harmony with the universally observed fact that wherever magical properties are attributed to objects these retain archaic forms unaffected by changes in all the other objects of social use, as for instance in the persistent use of stone axes and knives for sacrificial purposes.

MOHAMMEDAN ART

As we have seen, those countries over which Mohammedanism first pread were the homes of this new Christian art, and art there developed or a time along the same lines. Even the Mohammedan objection to the mages of men and animals did not take effect at first and never was bserved fully in Persia. Indeed the earlier centuries of Mohammedanism roduced an art as vital and as æsthetically free as that of Byzantium tself. The bronze sculptures of animals of Fatimite Egypt and a few imilar examples from Persia are consummate expressions of vital rhythms ondensed into a severely synthetic form. Pottery, particularly in Syria and ersia, produced a decorative art, in which animal forms predominate, f unsurpassed sensibility in the drawing and an exquisite taste in the roportions. None the less, in the long run the bad effects of the disaproval of figure design led to the development of an art of geometrical rnamentation, which became incoherent in its profuse repetition of imilar details. A certain intellectual indolence and a love of rich prousion gradually undermined the art of Mohammedan countries, until it as become almost the archetype of what vulgar taste and thoughtless ndustry can accomplish, although among unsophisticated craftsmen we nay still find evidence of the delicate sensibility to colour and form vhich distinguishes these peoples.

PAINTING AND SCULPTURE: N. AND W. EUROPE— THE END OF THE MIDDLE AGES

In North-Western Europe by the twelfth century the level of civilizaion and the consequent accumulation of wealth had proceeded far nough to admit of Church building on a large scale, and an extraordinary utburst of architectural experiment took place in most European ountries. With this went a great revival of sculpture. The output of the welfth century is enormous in quantity and shows an extraordinary ertility in the discovery of new sculptural ideas. To a great extent this culpture was subservient to architecture, and the problem of adapting culptural forms to given situations, such as the adornment of capitals nd the tympana or jambs of great entrance doorways, at the same time xpressing therein Christian doctrine and mythology, posed for the culptor the limiting conditions of his art. The sculptures had to have a ertain decorative richness of effect, and the dramatic and moral import f the scenes had to be made more or less clear to the onlooker. In many ays the art which was thus developed is curiously like that of Greece the sixth century B.C. There, too, a flourishing and relatively rich vilization was just emerging from a “ dark age ” ; there, too, the artists ere confronted with problems to which no traditional answer lay to and ; there, too, the decoration of sacred edifices was the occasion, and e narration of sacred legends the motive, of the sculpture.

In both cases the sculptors found, in the repetition of the small folds thin drapery clinging to the figure, a ready means of getting at once a ecorative “ colour ” effect and of describing the shape of the limbs, with the result that if one had only part of a draped figure from a twelfth century French church and part of one of the archaic statues of Greece to compare, one might almost be in doubt as to which was which. But in whole figures, still more in compositions, the differences would at once appear, for whereas the Greek was mainly preoccupied with realizing his idea of the harmoniously draped athletic body, the Romanesque sculptor's first concern was with the vivid narration of a sacred event or of some personality chosen for spiritual or moral rather than physical perfection. The result was that the Romanesque artist relied chiefly on facial expression. As to the body, he neglected its possibilities regarded as pure form and used it for the psychological values which its pose and movement could evoke. He attained to far greater variety of facial type and expression as compared to the fixed conventional smile of the early Greek. Moreover, as a natural outcome of the dramatic interplay of the figures, he devised rhythmic schemes which united many figures more clearly into a single design than the Greek artist had. Even in the treatment of the surface there is a difference. In sculpting the closely repeated folds of a drapery, or the strands of hair, or the feathers of a wing the Greek artist generally aimed at a mechanical regularity and uniformity of line, at an even perfection of finish, whereas in Romanesque art the artist's sensibility was generally allowed freer play.[1]

Towards the end of the twelfth century, Romanesque sculpture underwent a change almost exactly analogous to the change in Greek art from archaic to free. The decorative " coloured " effects given to details by repetitions of shallow grooves gave place to a more purely plastic treatment, freer and more significant movement of planes. Together with this, we note a new comprehension of the actual structure of the human figure and that easy control of varied and expressive gesture which grew out of the dramatic and psychological nature of the religious themes. Some of the figures of Prophets on Rheims cathedral must count among the supreme examples of plastic harmony. But already in the cathedral building of the thirteenth century a disturbing influence is at work. The complete mastery of the problem of stone-vaulting, which had just been attained, gave rise to a desire to exploit architecture with a view to publicity. The various towns vied with one another in the size and magnificence of their cathedrals. Not only was the possession of relics one of the best financial assets of a town or monastery, but the splendour and magnificence of the church which contained them would increase its celebrity. However the effect of this irruption of biological motives, which is so evident in thirteenth century architecture, is not so immediately evident in sculpture. Still, by the end of the century it had produced a distinct weakening of æsthetic feeling. A certain coyness of gesture and expression gives to the figures a more facile and popular charm ; an elegant complexity in the folds of the drapery adds to the arresting appeal and allows of an increasing display of purely technical dexterity. In the fourteenth century plastic significance was more and more sacrificed to decorative enrichment and a flattering sweetness in the psychological implications of the figures.

[1] Most of the German sculpture of the twelfth century, however, is markedly insensitive and harshly " finished."

We must turn now to the art of painting in Northern and Western
urope in the period from the fall of the Roman Empire to the end of the
Iiddle Ages. During the Dark Ages painting occupied a very peculiar
osition. It took the form of the illumination of manuscripts and was
rried on almost exclusively in monasteries. The tradition of the art
the earlier centuries was based on reminiscences of Roman wall paint-
gs as practised in the catacombs. This was progressively simplified, with
gradual loss of the knowledge of light and shade and space construction
which Greek art had attained. More and more it became a simple art
conventional outline drawing, with figures seen in frontal positions and
namental enrichments. This process was also hastened by influences
om Byzantine models. Painting, being carried on in monasteries upon
cient traditional models in almost complete seclusion from contem-
rary life, became a veritable orgy of stylistic experiment, with hardly
y controlling principle and above all without the inspiration which can
ly come from contemplating the infinite diversity of nature. Here again,
in later Chinese painting, we see an art, free from any anti-æsthetic
cial pressure, becoming enfeebled by the exclusive and narrow profes-
onal sophistication of its exponents. The Bayeux tapestry, with its
ave amateurish attempt to describe somehow or other a contemporary
ent, brings the possibility of a new spirit into painting and with the
nsiderable development of fresco painting on the walls of churches in
e twelfth century,[1] painting is once more started upon a sequence
hich runs more or less *pari passu* with that of contemporary sculpture,
ough with the usual lag in the matter of naturalistic representation and
derstanding of the human figure.

In the thirteenth century an event took place which, from the point of
ew of painting, was a merely external accident, but which none the less
ted very unfavourably on the development of painting in Northern
untries, and gave to Italian painting an immense handicap. This was
e French discovery of the art of vaulting and conveying the roof stresses
a relatively small number of supports. This allowed the walls to be
most entirely replaced by stained glass windows, which thus usurped the
ace which the fresco painter required. The Italians were never affected
this engineering enthusiasm; they continued to rely on walls to support
eir roofs and thus allowed scope for the painter. It was due to this cir-
mstance that in the Northern countries painting was confined to the
signing of stained glass windows, to which the simplest methods of
t contour design were best adapted, and to miniature painting. Now
e small scale of the miniature in illuminated manuscripts renders the
e comparatively indifferent to those effects, produced by the general
chitecture of the design, which are of the utmost importance in fresco
inting. On the other hand, minute realistic detail and intricately
namental enrichment have a special charm to the eye that can pore
er the page. The best illuminators were employed increasingly to
ecute Books of Hours for royal and princely patrons, and increasingly

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[1] St. Savin near Poitiers and the churches around Barcelona give us the
asure of this art, in which a more or less Byzantine formula is forced into a
de expressiveness. St. Eliza presso Nepi gives us the Italian analogue, already
more aware of pictorial science.

the artist was led to interest and amuse an idle curiosity by the exactitude of a rather trivial realism and to gratify the desire for luxury by profusion, intricacy and precision in the ornamental borders. By the end of the fourteenth century, with growing wealth and a growing frankness in the admission of mundane interests even in houses of devotion, these manuscripts became more and more luxurious and splendid and proportionately negligible as works of art. But the chief significance of these miniatures for the art of painting lay in the love of realistic representation. In the Hours of the Duc de Berri (about 1400), done by Pol de Limbourg and his brother, we get the first example of what we may call modern realism. The Duke was to be sustained during his attendance at church by the pleasant contemplation of exact likenesses of his various châteaux. The de Limbourgs painted in this Book of Hours a series of landscapes, in each of which one of the ducal châteaux appeared with the same kind of consistent realism as we are accustomed to in modern art. It is a measure of the extent to which the luxury motive had supplanted the æsthetic feeling, that these brilliantly executed paintings are almost devoid of any æsthetic quality. They are almost as purely descriptive as a photograph, and their appeal is to the trivial wonder at seeing such verisimilitude executed with such skill and technical dexterity. As we shall see, this quality of arousing an idle curiosity at mere likeness, and an equally insignificant wonder at professional skill, have remained ever since a constant element in European art. They have nothing to do with æsthetic satisfaction, though frequently confused with it. None the less, these works mark the beginning of the great efflorescence of realistic painting in Flanders throughout the fifteenth and sixteenth centuries.

Throughout the Middle Ages the Church was the chief patron of the arts and, in spite of the tendencies to large scale publicity in the building of the Gothic cathedrals, we note on the whole a relatively high state of æsthetic purity in the arts of sculpture and of painting until the rich private patron emerges. This phenomenon has led to the suggestion that religious institutions are more appreciative of æsthetic values than other employers of artists. But we have only to visit one of the large repositories of religious images in Paris, or to contemplate the lavish display of the most degraded art at a place like Lourdes, to recognize that the churches, as such, have no *parti pris* either for or against pure æsthetic expression. As much as the Pharaohs, or the Assyrian kings, or the modern industrial magnate, their concern is with propaganda or publicity. It is the means to arrest the attention and impress the imagination of the mass of mankind. All of these patrons choose, so far as they can, those works of art which they think most likely to have the widest appeal. When, then, we contemplate the æsthetic purity of French religious sculpture in the twelfth and thirteenth centuries, or of Italian painting in the fourteenth, and compare it with the low æsthetic quality of similar work to-day, are we to assume that the average man of those centuries was instinctively more sensitive to æsthetic values than his modern counterpart? To some extent no doubt this may be true, since we have to admit varying innate aptitudes for æsthetic feeling in different races and also the influence of climate and of social surroundings. But, as far as we can tell, these variations are not sufficient to explain the whole of the great difference for hich we have to account. And this observation leads us, I believe, to ecognize another factor in our problem. This is the factor of the long ontinuation of a particular civilization and culture. The organization of ur European civilization had only just been accomplished by the twelfth entury, and the art patron had no clear knowledge of what would appeal ost to the average man. It required centuries of a process of trial and rror before that could be fully ascertained. The peasant who admired a velfth century figure of the Madonna could not imagine the simpering, entimental and highly coloured image which his descendant can see in modern church. It took centuries for the Church to discover that this as what he really liked best. Knowledge of the elementary crudity of the verage man's sentimental reactions could only be attained by this long rocess of trial and error. It could not be discovered by the artist because, *hypothesi*, he is distinguished by the peculiar sensitiveness and sub- ety of his reactions. The main body of artists would and did actually ppose a resistance to this process. Only, little by little, their position was ndermined by the discovery of the greater effectiveness for publicity of e less sensitive members of the profession. Thus the long continuance a civilization tends, of itself, towards the production of an ever greater uantity of works of art into which no æsthetic element enters.

ITALY, AND THE TRADITION TO MODERN TIMES

We must turn now to Italy, where the frescoed wall was destined to ave a more propitious influence on the art of painting than the stained ass window and the miniatures of England, France and Germany. rom the end of the thirteenth century, for rather more than two cen- ries, Italian civilization made a creative effort in painting and sculpture ore intense and more continuous than any other of which we know. The nly possible parallels are Greece in the fifth and fourth centuries B.C. nd China at various periods until the end of the T'ang dynasty. As in ese cultures we find in Italy during this period the full recognition of the sthetic function as a spiritual activity. It was deliberately favoured in e social ambience of the governing classes who were by now the chief trons of art.

As we have seen, in speaking of Greece, European art was always loured by intellectual curiosity about the visible world. It was required the artist not only that his imagery should appeal to the emotions by rhythm, but that it should conform to the appearance of the actual orld. Its texture had to be as continuous and unbroken as that of the sible scene, a condition which, as we have seen, was not imposed on the tists of China. That continuity of texture might be obtained in two ways, ther by an accurate imitation of an actual scene or by constructing a cture according to those optical laws to which our vision inevitably nforms. The former, the empirical method, was used in Northern urope by Flemish artists, the latter, the scientific, was worked out in aly, especially by the Florentines, who first discovered the optical laws appearance. The great advantage of the scientific method is that it en- les the artist to construct imaginary scenes with nearly as great accuracy as real ones. He can place his figures in any pose and any position that the demands of his subject and of his rhythmic organization may require.

Byzantine painting had undergone a remarkable revival in the twelfth century, and Italy was in closer contact with this centre than the rest of Europe. The Italian artists were therefore, from the first, familiar with the principles which are essential to wall paintings on a great scale. They felt much more strongly than the Northern artists the claims of harmonious proportions in the disposition of their forms over the picture surface and of rhythmic flow in the contours. Although their intellectual curiosity was more scientific, their æsthetic feeling was strong enough to rule out the childish satisfaction of mere verisimilitude which proved so attractive to Northern art patrons.

Italian painting in the fourteenth and fifteenth centuries ran a course similar to that over which Greek painting must have passed before. From an art mainly of outlined figures seen in their frontal aspects and disposed more or less flatly across the picture space, they proceeded in the course of two centuries to discover how to represent more and more complex aspects of the figure, to increase the illusion of relief by modelling and to construct an ideated picture space which conformed to the laws of optics. But whilst recapturing the pictorial science of the Greeks, they did not altogether lose those powers of expressing the inner life by an intuitive rhythmic feeling which ancient art lacked and which was achieved in Christian art largely as a result of oriental influence.

Another distinction of Italian from other European arts was due to the wealth of its inheritance from Greece and Rome. The familiarity of Italian artists with the remains of Classical architecture and sculpture gave them, from the first, the idea of the harmoniously proportioned athletic type of the human body. Elsewhere artists liberated themselves with difficulty from the anti-sexual obsessions of Christianity, but in Italy this process—necessary for the completest plastic imagery—was more easily accomplished. Italian admiration for Classic art was in part due to antiquarian and historical interest, but was mainly æsthetic. It is a sign of the intense vitality of Italian culture at this period, that this admiration of the past was turned by these artists almost entirely into profit for their own art ; that they did not, as might so easily have happened in a highly civilized and self-conscious society, impair their own sensibility by slavish copying or pastiche. They used their models with intelligent freedom and self-assurance. Even when they set out deliberately to revive Roman architecture, they created a new style which was more elastic and capable of far greater extension and variation than the original. It is interesting to note that this great creative effort took place under certain political conditions which somewhat resembled those of ancient Greece ; namely that in both the country was divided into small city states. There seems to be a certain correlation between this and the possibility of the emergence of a large number of men of outstanding talent and marked individuality.

It is noteworthy that with all their scientific curiosity about appearance, their slowly gained control over the means of complete representation, the Italians never lost sight of the purely æsthetic qualities of their imagery. Each fresh acquisition of knowledge about appearance was at

ce utilized for those new possibilities of pictorial harmony which it
owed. It was scarcely ever exploited for the mere interest in realistic
risimilitude as such.

There have been but few periods in history when artists, working out
pure æsthetic possibilities of vision, have met with the kind of sympa-
etic support which the patrons and public of the Renaissance extended.
would, however, be absurd to imagine that non-æsthetic motives
re altogether absent. Collectors like Isabella d'Este acquired flattering
l pretty pictures, so far as they could get them. Alexander Borgia was
re pleased with the cheap finery of Pinturicchio's decorations than with
work of genuine artists, and even the Medici—excellent as their taste
nerally was—seem to have approved of the rather trivial realism of
nozzo Gozzoli's frescos. The prestige which lavish display confers
uld not be altogether eliminated, but in general the artist was not ex-
cted to compromise his individual sensibility. It is probable, too, that
opinion of other artists on any work was found to be of greater im-
rtance in the long run than the gratification of any particular patron.

Italian sculpture throughout this period presents a less consistent and
ntinuous development than painting, though the two arts frequently
eracted. Up to the mid-thirteenth century Italian sculpture was more
less in line with the general West European tradition, but at that point
eral sculptors, among whom Niccolo Pisano was the most distin-
ished, began a more deliberate imitation of Classical models than oc-
rred elsewhere. But this Græco-Roman revival was short lived, for
ccolo's son Giovanni used the new-found understanding of the figure
an art more akin to that of contemporary French sculpture. He even
shed much further than the French did the conception of the figure as
ehicle for the expression of psychological states. Under the stress of
ssion his figures became expressions of dynamic forces. In this he
nds somewhat apart from the general trend of Italian art in which, al-
ough the expression of the inner life was envisaged, the artists endea-
ured not to break too completely with the suave rhythms and broad
nes of Greek art.

In the art of painting, Giovanni Pisano's contemporary, Giotto, ef-
ted this compromise with such success that his general formula be-
ne the standard to which Italian artists continually referred through-
the next two centuries. An essential principle of Giotto's art lay in the
t that although he used the general Byzantine formula of significant
position of large simple contours across the flat surface of the work,
h little suggestion of light and shade, and an as yet necessarily imper-
statement of the depth of the scene, he drew these simple contours
h a vivid imaginative grasp of the volume and bulk of the figure. That
o say, his contour did not merely describe changes of direction in the
ne of the picture, but suggested the changes of direction of those
nes which recede from the eye.[1]

This is a difficult point to explain, but it is of crucial importance in the art of
nting. Perhaps it can best be illustrated by taking the case of an artist drawing
here. The contour of this will be a circle. If an artist, in drawing that, thinks
as merely the flat geometrical form of a circle, the line will be too precise
arresting to the eye to suggest the sphere. If, however, in drawing it he

It was this vivid imaginative grasp of the plastic implications of flat design that distinguished the Italian from Northern art and Gothic draughtsmanship. The Flemish artists evoked the illusion of reality by the minuteness and accuracy of their record of the changes of direction of contours in the picture plane, but this remained essentially a description of certain facts ; it failed to give vividly the suggestion of the volumes of the objects so described.

In order to understand this distinction, we must remember that painting and sculpture, in so far as they make recognizable images of natural objects, have a dual nature. On the one hand they may be illustrations of events or situations and, as such, capable to some extent of replacing a verbal description. Thus the illustrations of a book are an alternative way of stating the same events as those described in the text. On the other hand the painted or sculpted image may represent some situation of no interest or importance whatever, and yet may affect us by its pure formal relations in a way similar to that of architecture and music. Now illustration is likely to affect us by calling up emotions experienced in real life. For instance, a love-scene or one describing a violent conflict, either in writing or in illustration, will arouse reminiscences of emotions experienced in real life, and these evocations will share the precision and sharp limitation of such emotions. The effects of music, architecture and painting, viewed as pure form, though they may ultimately depend on the emotional life of the spectator, do not call up in the same way any particular experiences or any precisely defined feeling. They have a vague massive quality, and probably draw upon the deeper subconscious layers of our nature. These two effects of painting may perhaps work together, the massive formal effect lending weight and vastness to the more particularized emotions aroused by the illustration, or they may conflict, or either may preponderate to such a degree as to obliterate the other.

On the whole the particularized effect of illustration, since it calls up directly familiar emotional experiences, is more easily apprehended by the ordinary man, whose sensibility to the emotional overtones of form is generally weak as compared, for instance, with those of sound in music. On the other hand the emotional effect of a dramatic action in painting suffers from the grave defect that it can only represent a single moment, whereas literature can give the whole sequence. Painting often does inadequately what language does well, consequently pictures which rely solely on their illustrational effect tend to be rapidly exhausted, and in the long run only those in which the formal effect is powerful continue to be enjoyed.

For reasons which have never been fully investigated, it is found that

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thinks of the volume of the sphere as a whole and his contour as the sum of all the tangents of the sphere which lie at right angles to the picture plane, his line will be more likely to express the idea of volume, though it will probably not be so true a geometrical circle. This is of course a rather paradoxical statement, but it may suggest the truth that in the greatest draughtsmanship the contour expresses more emphatically the recession of the disappearing planes of the figure than the changes of direction in the picture plane. It was this truth that the Italians discovered, but which was missed by the Northern painters, who were preoccupied with the accuracy of their description and the calligraphic regularity of their lines.

ainted images, in which the volume and mass of objects and their spatial
elations are vividly suggested, exercise a much more powerful " archi-
ectural " or formal effect on the emotions than pictures in which this
iggestion is feeble or absent. Hence the great importance of the tradi-
on of pictorial design established by Giotto and elaborated for two cen-
ıries in Italy.

In Giotto's work the figures tend to be represented by preference in the
roadest flat extension, profile and full face, and the construction of the
icture space is uncertain. The discovery of perspective a century later
ave artists complete power to construct the picture space and regulate
ie relations of their figures within it. The study of anatomy and a grow-
ıg familiarity with the nude figure—in which the Italians retraversed the
ourse pursued before by Greek artists—gave them little by little the
ower to represent all aspects of the figure with equal ease. This at once
llowed of an immensely increased repertory of poses and of more com-
lex plastic rhythms. Finally, a careful study of light and shade enabled
tists to suggest more and more completely the full rotundity of their
olumes. By the beginning of the sixteenth century all these factors were
orked out, and artists like Leonardo da Vinci, Fra Bartolommeo,
Iichelangelo and Raphael were able to produce pictorical systems of
nheard-of perfection in all their plastic relations. These relations in all
ieir complexity were so clearly felt that their coherence becomes in-
antly apparent. The unity thus formed was more close-knit and in-
itable in all its parts than ever before.

Such in briefest outline was the evolution from 1300 to 1500 of this
most unparalleled effort of artistic creation. The process was not how-
ver perfectly continuous, there were periods of stagnation and periods
hen the main principle of development seemed to be lost sight of. But
each crucial point it was the good fortune of Italy at this period to pro-
ıce the men capable of re-establishing the true direction of æsthetic en-
eavour. At the outset of this period two alternative conceptions of art
e distinguishable. The Siennese, led by Duccio di Buoninsegna, were
nbued with the principles of Byzantine painting and had attained to the
eatest technical perfection. The Florentine school on the other hand,
iough influenced by the Byzantines, showed more indigenous tendencies.
Vith a lower standard of accomplishment they were more experimental,
ore anxious to attempt the record of their own visual experience and to
xpress in new forms the dramatic implications of the stories they painted.
this connection the recent history of their fellow countryman St.
rancis of Assisi was of capital importance, and it was in the fresco decora-
on of the great memorial church dedicated to him at Assisi that the
eatest of the Florentines, Cimabue and Giotto, created a distinctive
alian conception of painting. For whereas in the rendering of the main
isodes of Christian mythology Byzantine formulæ of composition lay
ady to the artist's hand, when it came to recording the actions of St.
ancis, which belonged to the artist's own country and almost to his own
me, he had to create everything from his own experience of contem-
rary life. With his rare feeling for the exact significance of gesture,
iotto was able to discover designs in which the dramatic situation
as vividly expressed and the effect of these on the imagination was

heightened by the corporeal reality of his figures. His contours revealed the solidity and bulk of the forms. They were no mere descriptions of certain appearances ; they had the firm consistency of real things.

Neither in drawing nor in colour had Giotto's designs quite the elegant and flowing perfection of those of his Siennese contemporaries, but the gain in vividness and the sense of reality were of incomparable importance for the future of Italian painting.

And yet for nearly a century after Giotto's death it was still by no means certain whether the Siennese or the Florentine conception would predominate. Sienna produced in the next generation several artists of great power, of whom Simone Martini is the most important. Duccio di Buoninsegna had already modified the Byzantine tradition by softening the harshness of its rigid hieratic forms. Simone Martini carried this process much further, creating in his contours linear rhythms of incomparable suavity and charm capable of expressing the more intimate and tender humanity which had begun to colour the religious sentiment of the day. The change thus effected was similar to that which had taken place in French sculpture a century earlier. Simone Martini was creating what we may call a Gothic style of painting. It was far more masterly and more expressive than any of the Gothic painting of Northern Europe, but it might well have led Italian art along similar lines, for meanwhile Giotto's successors in Florence lacked initiative and originality. Giotto's style was copied, but without intelligence, and the Florentine school seemed to be already attacked by the disease of a lifeless academic formalism. By the end of the fourteenth century the most vital of Florentine painters, Lorenzo Monaco, had frankly adopted Siennese conceptions, and a similar style of elegant Gothic linear design without any research for plastic values was spreading to the other centres of art in Italy, even taking over German Gothic conceptions in Northern schools like that of Verona. Had this tendency persisted the Italians would have merely been the best exponents of a common European tradition ; they would not have created a new and quite distinct conception of the possibilities of pictorial design as in fact they did.

For at the critical moment there arose in Florence a group of men of extraordinary originality and creative energy. Leo Battista Alberti, the great architect and mathematician of the fifteenth century, in his book on painting, says that : " the spirit of the ancients passed into the frames of Ghiberti, Brunelleschi, Donatello and Masaccio and fitted them for the most honourable exercises." And it was indeed due to this group of Florentines that the tradition of European art took its actual course. We see from Alberti's words that what appeared capital to their followers was the return to the spirit of Græco-Roman culture, the fact that they picked up again the thread of tradition which had been broken by the centuries that intervened since the fall of the Roman Empire. We have seen that more or less distorted reminiscences of that culture had persisted intermittently throughout this period, but now for the first time the study of Classical art became scientific and critical. In fact civilization in Florence at the end of the fourteenth century had reached such a high level of spiritual self-consciousness as to feel its kinship with the great achievements of Greek culture far more clearly than with those of the immediate

st. The art of those recent Mediæval periods was too naïve, too in-
inctive and too little penetrated by any conscious intellectual concep-
ons to satisfy them any longer. Their own complete self-conscious
vareness of the spiritual functions of art demanded for its expression a
cher, more articulate, more intellectual artistic language, and in the
mains of Græco-Roman art they believed that this language was to be
scovered.

But the Florentines of the Renaissance, though they turned deliber-
ely to the past, were not engaged in an archaistic revival. On the con-
ary, for them, Classical art was not simpler, more rudimentary, but
ore accomplished, more learned, more intellectual than the Gothic art
their own past. They did not go to it for a release from over-sophis-
cated technical skill, but rather for an enrichment and completion of
eir own knowledge. The spirit of the Renaissance was, then, the exact
pposite of the spirit of archaism. It was a spirit of self-confident and
thusiastic adventure. The Florentines did not set out to copy the
cients but to make use of ancient methods for their own ends, and that
iefly in two respects. One was the greater knowledge of the anatomical
ructure of the figure, a greater familiarity with the play of the various
uscles in action and of the poses which led to harmonious plastic
quences. The other aspect of Classical art was concerned mainly with
chitecture, though it strongly affected the decorative accessories and
e general ordering of design. The Italians had never fully adopted the
othic systems of building developed in France. Their Gothic construc-
on had been essentially half-hearted, and by 1400 they were ready to
udy with enthusiasm the remains of Roman architecture which were
ill standing. What they found in them was the constant use of a rela-
vely small number of forms combined in a vigorously co-ordinated
stem, as opposed to the variety and irregularity of Gothic design. It was
e clarity and legibility of the disposition of the structural element,
hich they discovered in Roman architecture and its decorative enrich-
ents, which satisfied their intimate needs. And this systematic clarity of
-ordination of parts in a whole, which they discovered in architecture,
as applied by them also to their sculptural and pictorial designs.

To return to the four great men who effected this momentous change.
hiberti and Brunelleschi were born in 1378 and 1377. Donatello and
asaccio were considerably younger. Ghiberti, as a sculptor, was essen-
lly an exponent of that Gothic style which we found characteristic of
e painting of this period, though in his celebrated bas-reliefs for the
ors of the Baptistery he combined it with an ultra-picturesque use of
rspective backgrounds and highly realistic ornaments, both prophetic
certain nineteenth century misunderstandings of the possibilities of
ulpture. It was not as an artist therefore that he counted for much in
e new movement, but rather as a student and collector of ancient art.
e had actually procured a marble vase from Greece, and was probably
e first to recognize the difference between Greek and Roman art and to
ist on the greater value of the former.

Brunelleschi, after making a few sculptures which prove what a great
ulptor he might have been, turned to engineering and architecture and
ved the problem of constructing the dome of the cathedral. But he

was a man of wide intellectual and æsthetic range, and seems to have been the real discoverer of the laws of perspective which gave a new power of pictorial space construction. Donatello was one of the most daringly original artists of all time. He quickly freed himself from the facile and unstructural rhythms of the Gothic style, and established that conception of sculpture as a harmony of structural plastic sequences which has been the basis of all subsequent European sculpture. He studied Classic models deeply, but used his acquired sculptural knowledge with the most daring freedom, with a profound understanding of the significance of pose for the expression of character and of psychological states, which far transcended the limits of that Classical art which he took for master. And herein we touch on the fundamental importance of the Renaissance style. For though Donatello doubtless thought of the Greeks as superior to himself, though his utmost ambition may have been to recapture their spirit, he fortunately did not throw over those invaluable new qualities which came into the European tradition, mainly, as we have seen, from the East, namely, that feeling for the expression of character and the understanding of rhythms expressive of the inner life. Thanks to this, Renaissance art did not go back to the descriptive attitude which marked so much of Greek art. Even if it missed the static perfection of the finest Greek sculptors, it more than compensated for that by its profounder sense of character, its vital and pervasive rhythms and the richer conception of life which it was able to handle.

Though he never actually painted, Donatello shows himself in his bas-reliefs as an almost greater master of pictorial than of sculptural composition, and his influence on painting was immense. Fortunately, too, he found in his younger contemporary Masaccio a man of genius equal to his own and exactly attuned to the same conceptions of art. Considering what he accomplished before he died at the age of twenty-seven, we must account Masaccio as almost the most surprising manifestation of genius in the art of painting of which we know. Masaccio mastered at once the new ideas of the Renaissance. He learned how to give to his painted figures something of the structurally plastic unity of Donatello's sculpture. He used with ease the new perspective methods of space constructions. But the mastery of such new methods produced no evidence of strain or distortion in his work, nor did his enthusiasm for Classic art lead him to neglect what Italian painting had already achieved. With unerring instinct for the essential he founded his pictorial composition on Giotto and recovered at once the large clarity of disposition which had been lost sight of by Giotto's academic descendants. He gave to compositions based on Giotto's principles a fullness of relief and a depth of space which Giotto lacked the pictorial science to achieve.

This meant the final and decisive establishment of the Florentine conception of art as the predominant and central factor in the Italian tradition. The alternative Siennese conception, and the later Gothic design which had spread more or less all over Italy, were no longer able to compete with the plastic design to which Giotto had first given expression. Thus Masaccio committed European art to that age-long exploration of the appearances of external nature which was destined to be so singularly fruitful of ever fresh artistic possibilities. From this time it was generally accepted in European art that the structure of a painted image must be in more or less accordance with our visual experience of the external world. As we have seen, this was by no means inevitable ; great arts had arisen and flourished elsewhere without endeavouring to conciliate pictorial design and the texture of the visible world. It carried into new regions the same principle that had governed the Greek realization of the structure of the human figure.

Science, as we have seen, had already been called in aid to establish the laws of perspective, and this was immediately followed by the analytic study of human and animal structures by means of dissection. A little later, Leonardo began a scientific study of the colour effects of the atmosphere and the principles which govern the changes in the local colour of objects in various situations. In Leonardo's scientific investigation into the laws of appearance he far outran the practice of his day, and the principles he laid down only found their application to painting in the Impressionist school of the nineteenth century.

The Florentine artists of the fifteenth century were, in effect, the precursors of modern science, and their gradual exploration of the nature of visual experience gives to the history of European art a certain resemblance to that continual progress which fascinates us by its dramatic character in the study of scientific history. It has even led to an idea that there is, in any given culture, a normal course of evolution and a progress to ever greater powers. As we have seen, however, there may be long courses of artistic tradition with no such changes in the amount of visual experience which the artist takes over. In fact the exploration and explanation of visual appearances form a branch of science, though it is one which has naturally been mainly pursued by artists. But an increased knowledge of the facts of visual experience by no means necessitates increased power of exploiting them in art. It so happened that all the greatest Florentine artists of the fifteenth century were also those who accepted with most avidity the new discoveries in visual experience, but for the student of art the only point is what use they made of this new material. The worst painter of to-day can give to his picture truer perspective and truer light and shade than Giotto could, but this does not make him a better artist. The æsthetic value of a work of art is, in fact, independent of its factual content.

The great Florentines of the Renaissance never made the mistake of confusing their new science with their art. They used the new principles solely to increase the organic unity and completeness of their plastic and spatial harmonies. It is the quality of these harmonies, the elevation of imaginative feeling which they express, that makes the great importance of their creations.

At the same time that Masaccio was working in Florence there began in the Northern Italian schools an interest in visible nature of a very different kind. This was the result of a naïve curiosity in the variety and diversity of natural forms akin to that which we have noted in Flanders. This naïve naturalism led artists to delineate a number of plants, animals and objects which had never before attracted the painter's attention, but it implied no greater grasp of the relations of objects to one another in the visual field. Its effect indeed was almost the reverse of the Florentine study of the laws of appearance. That had increased the integrity and continuity of the whole design ; this naturalistic curiosity tended to disperse the attraction to the eye, calling our attention sharply now to one detail and now to another and appealing to the idle pleasure that we take in seeing the exact and detailed imitation of some real thing. To some extent the impulse towards this naturalism affected the Florentine school throughout the fifteenth century. Although the greater painters, like Castagno, Piero della Francesca and Signorelli were but little affected by it, and carried on in the great style of Masaccio, a less severe art naturally achieved success by its more flattering appeal. Benozzo Gozzoli's frescos, crowded with naturalistic detail, Ghirlandajo's hard and literal portrait heads and Filippino Lippi's fluid sentimentality appealed to those who were incapable of a purely æsthetic response, and already we have a hint of that separation of painting into two branches, the æsthetic and the popular, which was destined to increase in the succeeding centuries. No less than painting, sculpture fell away from the great plastic character of Donatello's art and aimed at decorative elegance and a slighter, more sentimental charm.

In all this period, however, much visual knowledge was being acquired, including a detailed familiarity with the structure and muscular functioning of the body and the solution of the more complicated problems of perspective. None the less, amidst this wealth of material, the great synthetic grasp of Masaccio's art was lacking ; painting had become more varied, more intriguing, but had lost its monumental simplicity and grandeur. Once more, at the turn of the century, a group of great artists flourished, and once more the grand lines of the Florentine tradition were reasserted. Leonardo da Vinci, Fra Bartolommeo, Michelangelo and Raphael, all contributed in different ways towards an art of broader and more closely knit unity of design, handling the completer knowledge of natural appearance which the fifteenth century had accumulated with masterly care, in broadly synthetic constructions. Michelangelo, by his bold foreshortenings of the figure, increased the power of expressing movements to and from the spectator and thereby suggesting the full relief of plastic groups. Fra Bartolommeo and Raphael captured as never before the harmonic relations of the volumes to the picture space, the last trace of flatness disappeared from the imagery, leaving the figures standing free and encircled by aerial spaces. It is doubtful whether ever before or since pictorial art has achieved such a close-knit unity of design with so much appearance of ease and naturalness, so little evidence of the strict formal principles to which the artist conformed.

Though Michelangelo's influence upon the painters who realized this perfect pictorial system was immense, in his own paintings he remained essentially sculptural, that is to say, he could create volumes in all the fullness of their relief, but he lacked Raphael's sense of the relations of volumes to the surrounding picture space. As a sculptor he returned to the great conceptions of Donatello which had been lost sight of by the intervening generations of sculptors. His imaginative temperament was however less penetrating and profound, more emphatic and rhetorical, with a bias towards the grandiose. But the methods he discovered in order to produce this effect are of great importance, since they formed the basis of design in the succeeding period. For it is generally admitted that Michelangelo, more than any one other artist, created the Baroque style.

In the Classical, or High Renaissance, style of Fra Bartolommeo, Leonardo and Raphael the unity is composed of parts which are coordinated so as to build up a single structure, but they remain distinguishable as constituent elements, and each element has its own rhythmic phrase. In the Baroque there is a single predominant motive to which all the others are subordinated. This is most clearly seen in architecture, and it was in his architecture that Michelangelo most clearly enunciated the Baroque idea. In Renaissance architecture, each story of a building composes a distinct and separate unit with its own system of columns or pilasters, though the various stories have a strictly coordinated relation to one another. In Baroque, the whole façade is treated as a single unit with columns going the whole height and bracketing the stories into a single architectural phrase.

In the same way, in his sculpture, Michelangelo created a single unbroken rhythmic phrase which passed through the whole figure. Such prolonged rhythmic phrases were particularly attainable in figures in those vigorous and declamatory gestures which he affected, and throughout the succeeding epoch sculptors developed this theme of vehement and agitated movement, sometimes to an extravagant degree. We shall follow later the developments of the Baroque style during the seventeenth century.

The art of the High Renaissance made an extraordinary appeal to the world at large, and when Raphael died at the age of thirty-seven his death was mourned as a public calamity by the Papal Court and the people of Rome. One cannot doubt that the spending of immense sums by the Popes of this period on works of art was largely inspired by the motive of publicity, though its effect in Protestant countries was by no means conciliatory. But it is noteworthy of this remarkable period, that it was the best work of the greatest artists that was considered most effective as propaganda. This shows the high general level of artistic culture of the day. Except for a certain pressure upon artists to produce more rapidly than they felt inclined, from which Raphael certainly suffered, there is ittle evidence of the deadening effect on art which conformity to the demands of publicity generally produces.

None the less this extraordinary outburst of artistic activity left the talian tradition, so far as Rome and Florence were concerned, in an unhealthy condition. The extraordinary perfection of Raphael's art and he impressiveness of Michelangelo's were so effective, that artists hought that all they had to do was to produce works which repeated hese qualities. The Mannerists, as they are called, endeavoured merely o create in the manner of their great predecessors. They unconsciously xaggerated the sentimental charm of Raphael's figures and underlined he already emphatic art of Michelangelo, in the simple faith that if only he gestures were sufficiently vehement, the foreshortenings sufficiently aring, they were doing all that was needed. We note, by the way, how ften Academism treads in the footsteps of great geniuses. We ought erhaps to distinguish between those great originators, who open up a new way of research, and those who seem to bar the future by a too complete realization. But perhaps the type of artist who takes up the succession may be a more determining factor in the subsequent course of tradition.

Had it not been for the independent schools of Northern Italy, the Italian tradition would have ceased to be creative with the advent of the Mannerists. Of these Northern schools Venice was the most important. In spite of occasional contacts with Florence, the Venetian artists had never taken up the pursuits of plastic design and space construction with anything like the same scientific ardour and passionate intensity as the Florentines. They practised a more naïve, more descriptive and less conscious art. Their attitude to life was more easy-going, less tense and less impassioned. But they had a deep instinctive sense of the beauty of nature which led them from the first to conceive the landscape backgrounds of their sacred imagery as of equal importance with the figures. And this led them to observe a whole aspect of nature which the Florentines had neglected. The latter had been so absorbed in the realization of complete formal design, that they allowed only an ancillary position to colour. Their colour was often extremely harmonious, but it was conceived as an adjunct to the design, not as an inevitable part of it. The choice of colour was moreover mainly dictated by *a priori* feeling for harmony. But the Venetians, in studying landscape, had come to an apprehension of the pervasive effects on all the separate local colours of a scene due to the particular state of light, to the time of day and the quality of the daylight. Giovanni Bellini always felt this strongly, and his pictures are generally conceived as expressions of a particular quality of light, all his colours being harmoniously attuned to this dominant effect. Thus colour becomes not merely decorative, but aids in the situation of the volumes within the luminous space of the picture. The implications of this discovery were not worked out till the landscape painting of the seventeenth century in Holland and, still more completely, in that of the nineteenth century in France and England.

Giorgione gave to Bellini's ideas a new significance. In his tragically short life he created a conception of art which has exercised as potent and intimate a spell on succeeding generations as any other. He expressed more completely than anyone else that synthesis between Paganism and Christianity which lies at the root of our imaginative life. Christianity had in effect denied nature, as it denied the natural man, but it was inevitable that those feelings which link us to the life of Nature should find expression. It was this that Giorgione accomplished by relating intimately the human figure to landscape and expressing in that the profoundest overtones of our feeling towards the life of Nature. The influence of this was immense and inspired a new creative impetus among his contemporaries and followers, of whom Titian was by far the most gifted. In his long life he did much to develop the Baroque conception of pictorial design, both in the form of his compositions but still more in his use of colour. In accordance with the Baroque idea of subordination to a single theme, he broke down the isolation of local colours and imposed a dominant chord throughout the whole composition.

The Venetian school was never attacked by the Academic disease that destroyed the Florentine, and Tintoretto and Veronese continued to produce fresh and vivid work, though mainly of a secondary and decorative quality, throughout the century.

In Parma, Correggio, working in complete isolation, made the most daring experiments in Baroque composition, using a greater atmospheric fusion of tones and a richer play of light and shade than any before. But Italy was not in a state, at this time, to seize on the possibilities which Correggio's genius provided. It was divided between the academics, who harked back to Raphael, and the followers of a brilliant charlatan, Caravaggio, whose apparition marks a new phrase in the history of art.

The artists of the Middle Ages and Renaissance had a strong corporate consciousness. They were continually required to appraise one another's works, and in general an artist was at least as much affected by the opinion of his colleagues as a doctor is to-day. When, in the seventeenth century, the guild of artists was replaced by an academy, which represented only one party of artists, and that the more pedantic and less vital one, the inevitable response was to break entirely with the professional body and appeal directly to the public, just as a quack doctor does to-day. It was this defiance of professional opinion, this appeal to the public at large, that distinguished Caravaggio's position. It is one of the ironies of history that the kind of vulgar popular art of which Caravaggio was the initiator is precisely the type of art that has since captured the Academies and bears the misnomer of Academic art.

Caravaggio appealed by means of the topical, anecdotic subjects which he painted, such as the scene of a young and rich innocent cheated by card-sharpers. He even treated religious scenes in the same spirit. But vulgar and *ad captandum* as his art was, he had a touch of genius. He explored the melodramatic possibilities of light and shade, painting scenes immersed in darkness with a bright light striking in through a narrow aperture, and bringing certain features into strong relief. This led to a new kind of design, in which the contours counted for very little as compared to the pattern made by the edges which divided the strongly lit planes from those in shadow. A whole school of so-called " Tenebrosi " resulted. This would have been of little consequence but that elsewhere, in Spain particularly, and to some extent in Holland, his idea was taken over by far more serious and genuine artists. Even Velasquez's extraordinarily sober and refined art owed much, in its inception, to Caravaggio's example.

In sculpture seventeenth century Italy was more fortunate, since it was dominated by the genius of Bernini, who created the full Baroque conception of that art, developing to the utmost what was already implicit in Michelangelo. He not only created continuous and pervading rhythmic movement throughout his groups, but he broke down the contour by haded planes, giving thereby a new quality of picturesqueness and movement to the whole effect. This conception of sculpture dominated the talian and also the French school throughout the seventeenth and ighteenth centuries.

We must now turn back to the Northern schools, of which the Flemish ook precedence, the German school being essentially a minor derivative f the Flemish, and the French, though more independent, far less productive. We saw that at the beginning of the fifteenth century Flemish artists had acquired a notion of the exact description of actual scenes. It was not surprising that people, who had been accustomed only to the generalized decorative imagery of mediæval times, should be fascinated by the novelty of some familiar scene rendered with astonishing verisimilitude and an inexhaustible wealth of minute detail. It was Jan van Eyck who first fully realized this conception, and with such skill that his picture of a fifteenth century interior[1] still astonishes us by the incredible accuracy of his description. The appeal however was mainly to curiosity; no great emotional effect was envisaged or achieved, but a standard of verisimilitude was set which influenced the whole Flemish school. Now since preoccupation with those details which most arouse the idea of verisimilitude implies a different focus of attention from that whereby we perceive the volume and relief of objects, the Flemish were never led to attempt the Italian conception of plastic design but contented themselves mainly with exploiting the illustrational aspect of art, sometimes creating great imaginative " visual literature," as in the case of Rogier van der Weyden and Peter Breughel, more often satisfying their clients by the sentimental charm of their figures and the minuteness of their detail. Such was the situation throughout the fifteenth and sixteenth centuries. In the seventeenth century, however, Rubens, after studying in Italy, where he embraced the Italian tradition, brought it back to Flanders and developed it along new lines. By the urge of his flowing rhythms he was able to hold a more complex material within the compass of a single phrase. And this Baroque idea he even carried further than had been done before, increasing at once the richness of content and the visible unity of his designs. By thus transplanting to the North the Baroque tradition, he changed the future of those Northern schools where his influence predominated.

His brilliant pupil Vandyck worked in England and developed a style of decorative portraiture which has had great influence. He was the first to insist on the social pretensions of the sitter at the expense of real character, a discovery which has been largely exploited by biological forces in modern times.

One school however, the Dutch, was developing along independent lines. It had shared the literal imitative conception of Flemish painting, but the peculiar mentality of the Dutch led them in the seventeenth century to inquire more closely into visual experience. They were brought to this, in part by their stolid Protestant indifference to the subject matter of the imaginative painting of the day, which was drawn either from religion as interpreted by the Roman Catholic Church or from Pagan mythology, and in part by their passionate appreciation of that national way of life which they had just so heroically defended against Spain. They demanded, therefore, an art capable of treating the familiar scenes and situations which they loved. But for all their lack of distinctively poetic feeling, their bourgeois sensuality was tinged with a reflective spirit, so that even a roystering publican like Jan Steen could look with a certain detachment on the revels in which he shared. To effect such a shift of focus of the imaginative faculty was a great feat, though it was perhaps performed almost unconsciously by the Dutch in response to their particular situation. And it was this that enabled them to take that step in the exploitation of visual experience for its æsthetic possibilities before which the great Italian enterprise had come to a pause. To realize its full importance we must return to their position. The Italians had indeed explored visual experience very fully, but they never trusted themselves entirely and exclusively to the visual experience of a scene from a single point of view. They allowed themselves, as it were, the privilege of walking round the figures or objects, in order to see what they were, more clearly than the single viewpoint allowed. They included too experiences gained from touch, from feeling the shapes. That is to say, they continued to regard each figure or object as a separate entity ; they painted them so as to give to each its fullest reality as a single whole, though they combined these to build up a plastic unity. It was this new step of trusting to purely visual values in order to express form that was taken by the Dutch. Its consequences were immense. It implied, when pushed to its limit, an undoing of that education of the eye under the influence of conceptual language through which we pass in infancy. It was not, however, until the latter half of the nineteenth century that the Impressionists worked out the full consequences of this Dutch initiative. But from the very first this disinterested contemplation of the scenes of everyday life revealed a whole new range of plastic and spatial relations capable of giving rise to many new types of pictorial harmony, types which could never have been conceived had the artist started from an *a priori* rhythmic idea.

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[1] *John Arnolfini and his wife*. National Gallery, London.

At the same period a similar step into the world of unaided vision was taken in Spain, but here its greatest manifestation was due to a court painter; Velasquez's contemplative perception of the pictorial possibilities of life in the royal palace.

The conditions of art production in the seventeenth century are important for our study. In Belgium and Spain, Rubens and Velasquez were working mainly for the royal patrons who carried on the tradition of the Renaissance, in that they were able to accept the pure æsthetic activity of their artists even when this led them into new and unfamiliar regions. But in Holland the painters had to work for the bourgeoisie, many of whom were rising in the social scale and were using the patronage of art as a social weapon. As we have seen, such a situation always produces the phenomenon of vulgarity, and the demand for the luxury effect in objects of art. Great verisimilitude these patrons demanded from a genuine but non-æsthetic curiosity, and a highly polished surface and mechanical precision of handling they required as an expression of luxury. What is surprising, however, is the extent to which these Dutch artists were able to express their genuine æsthetic impulses whilst conforming more or less to this non-æsthetic demand, though the greatest of all, Rembrandt, was financially ruined by his refusal to make the compromise.

Rembrandt has a unique place in the history of European art, because he united in his spirit a dramatic and psychological imagination of Shakespearean intensity and an equally great plastic imagination. In his early work the illustration of psychological conceptions sometimes impairs the complete formal unity, but in his later years he accomplished a perfect fusion of the two elements in his imaginative life.

In landscape the Dutch pushed the observation of effects of colour and tone to a much further point than the Venetians, and attained to a subtlety and nicety of tone and colour values which have never been surpassed.

It is one of the strangest phenomena in art history that Holland, after producing for about thirty years an exceptional number of artists of genius or supreme talent, suddenly became barren of artistic talent, and, for no apparent external reason, this extraordinary efflorescence of creative power disappeared almost completely and suddenly, though the Dutch people have continued to be distinguished for a finer taste in art than those of other Germanic countries.

Already in the seventeenth century France had produced two great artists, Poussin and Claude, who both studied in Rome and gave a new vitality to the tradition which still survived there, though in an enfeebled state. From the beginning of the eighteenth century until the present day France has been the one great centre of artistic creation in Europe.

In the eighteenth century Watteau refined upon Rubens's conceptions, adapting them to a more intimate and poetically contemplative interpretation of the life of the Court. Chardin painted still-lifes which equalled the Dutch in truthfulness of observation and surpassed them in the richness of his tone and colour harmonies. But the chief activity of French art during this century was the creation of a style of decorative compositions based on Rubens's example. The eighteenth century was, on the whole, one of exquisite minor work, devoted chiefly to the embellishment of the intense social life of the time. In Venice, however, it produced a surprising aftermath of the great tradition in Tiepolo and a landscape art of a relatively modern kind in Canaletto. An equally extraordinary revival of art, with modern elements but in harmony with the great style of the seventeenth century, occurred in Spain in the isolated figure of Goya.

In the early nineteenth century, England, in the person of Constable, made, for the first time, an important contribution to the development of the European tradition. Constable went a great deal further than any before in the process of disintegrating the separate objects within a field of vision. Refusing to pay separate attention to those sensations out of which we build up an object such as a tree or a house, he was able to realize, as never before, the continuity of light and colour throughout the whole scene, and to establish an unbroken plastic texture throughout. His idea was still-born in England but was taken up in the latter half of the century by the French Impressionists, who worked out its implications with extraordinary zeal, and with a scientific method analogous to that which the Italian discoverers of linear perspective had shown. The new problem was that of tone and colour perspective due to the atmosphere and, though the effects are too complicated to admit of any simple mathematical statement, the general principles were grasped and practised with great exactitude. Enthusiasm for these newly-discovered aspects of Nature led these artists, however, to overstate the continuity of texture of a field of vision and to understate those sensations whence we construct the notion of separate things. As a result of this bias the architectonic organization of pictorial design was inevitably weakened.

A reaction from this extreme was begun by Cézanne and later, independently, by Seurat, and, by the beginning of this century, this reaction had moved rapidly towards an almost Byzantine conception of design by means of large simplified contours. The shock given by this sudden reversion has led to a period of free speculation on the whole nature and purpose of the painted image, with experiments towards an abstract, non-representational art and finally, in sur-realism, to a return to the concept as the unit of design. Meanwhile a form of Impressionism, influenced by severer architectonic principles, has remained the chief idiom of modern painting.

Paris has been the centre of all these artistic movements. In England, Constable remained an isolated figure. With their essentially literary bias, the English have never understood plastic art, and have been content to practise an art of decorative illustration. Throughout the nineteenth century the literary content of nearly all this art was of the feeblest kind. The attempt of the pre-Raphaelites in the sixties and seventies to raise the imaginative level of pictorial narrative and give to it a decorative quality had some success, but they were almost as insensitive to plastic construction as the popular anecdote painters against whom they rebelled. It was only in the Impressionist work of Mr. Steer and in that of some twentieth century artists that some conception of plastic design has found a precarious place in this country.

Throughout modern times, from the end of the Renaissance on, sculpture has played a relatively small part. For one thing, the new visual material of atmospheric colour and tone which the painters were exploring gave no opportunity for sculpture. For another, the cost of sculpture being great, the chief opportunities have always been for public monuments and these are peculiarly open to non-æsthetic claims, especially since democracy has tended to make everyone feel himself as well qualified to give an artistic judgment as anybody else. Sculpture has therefore rarely been practised by any but academic-popular artists. In quite recent times, however, two or three great artists have managed to find support for independent sculpture and have even gained a grudging admission to execute minor monuments. But the enormous patronage of sculpture which the monuments of the last war entailed has been, almost without exception, given to non-æsthetic work which was judged to have a strong publicity effect.

The economic and social status of modern painting has been full of curious complications. The immense industrial expansion of the nineteenth century, with the consequent rise of many people of elementary spiritual development to wealth and social position, produced the phenomenon of vulgarity on an even grander scale than during the Roman Empire. These patrons were willing to pay large prices for works which, by their trivial verisimilitude and obvious sentimental appeal, were easily apprehended and also for portraits which might advertise their social position. These non-æsthetic demands led to the growth of a large class of artists, with some technical skill and low sensibility, and these became so powerful that they were able to capture the Academies, which were originally intended to check such non-æsthetic art production. Thus the artists who were carrying on the tradition found themselves without any support, in a social ambience violently hostile to their activities. Such a situation might have led to a total neglect of art similar to that which took place during the Roman Empire, as is described by Petronius Arbiter. But the fact that wealth was more widely distributed in the nineteenth century implied that some of these artists had independent means, whilst others found a precarious support from a few exceptional collectors and from picture dealers. Moreover, there was a much clearer consciousness of the rôle of art as a function of the spiritual life, and the idea grew up of the artist belonging to a kind of priesthood and having a vocation. The notion of artistic conscience became clear. Thus the work of these traditionalists, who were always denounced as revolutionaries, became gradually accepted, and in the long run their works changed hands at far higher prices than those of the academic-popular painters. Little by little, as their works entered the public museums, they were seen to be the real transmitters of the long European tradition.

These museums and public galleries began to function from early in the nineteenth century and their influence upon public taste and appreciation of art has been steadily growing. They have unconsciously made it evident how far academic-popular art has been from the tradition. The effect of this has been to replace the confident Philistinism of the nineteenth century public by an attitude of anxiety to accept some authoritative guidance of their æsthetic reactions. This too has been captured by biological forces and the new attitude, for which the word " Snobbism " has been coined, is being exploited by picture-dealers who sell works of startling and fictitious originality which are accepted almost in proportion to their lack of any evident charm.

Another phenomenon of twentieth century art is the recognition of the hypnotic influence of imagery by the great industrial concerns, and the increasing employment of artists for poster designs. There are signs that these magnates are beginning to enjoy the prestige value which art confers on them almost as much as its economic value, which indeed tends to grow less with its general use. If this is the case, they will be found repeating almost exactly the attitude of the great royal advertisers of ancient times.

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THE THEORY AND PRACTICE OF ARCHITECTURE

By

C. H. REILLY

SYNOPSIS

1 The scope of architecture — The quality of the appeal to the imagination in buildings which makes them worthy of the term architecture.

2 An analysis of the appeal made by past architecture in the main line of our descent and the chief contribution of each period to the common stock of architectural ideas; the contribution of Egypt, Greece, Rome, Byzantium, of the Gothic period, of the Renaissance and the Baroque.

3 General principles of design — Certain criteria applicable to all buildings irrespective of style such as unity, scale, proportion, inflection and punctuation.

4 The practice of architecture — Modern architects as heirs to the past — The modern schools of thought: (*a*) the Classicists; (*b*) the Gothicists; (*c*) the Eclectics; (*d*) the Modernists.

5 The general effect of modern materials such as steel, ferro-concrete and glass on design. Their special effect on: (1) vertical expression; (2) horizontal expression. Modern development in America and on the continent of Europe.

THE THEORY AND PRACTICE OF ARCHITECTURE

Architecture is one of those subjects whose content is difficult to define, but in spite of this everybody has ideas, more or less hazy, as to what the word implies. It is obviously something more than mere building, though not, as some would appear to think, only concerned with cathedrals and buildings of the first class. Is there, on the other hand, any building, even a corrugated iron shed, which under certain circumstances is not worthy of the term ? Certainly it is easy to conceive such a shed, so shaped, composed and coloured that it holds the imagination as securely as some more substantial building to which no one would deny the term. The only reason therefore why all building is not architecture is that we are not yet willing or able, as the Greeks appear to have been, to make it so. We must therefore at the outset consider the conditions which convert mere building into architecture.

We have a hint of these conditions in the word " imagination." A building appeals to the imagination of the beholder. But it may appeal to his imagination in many ways. It might appeal through his imagination to his greed. That sort of appeal would obviously not convert the building into architecture. It might only mean that to him the materials were more valuable in themselves when they were redistributed and the building thereby destroyed, which is a *reductio ad absurdum* of the first order. The appeal to the imagination unqualified is therefore not enough. The qualification, however, is difficult to define. Many buildings, some the most respected in the world, make their appeal for historical reasons. Something has happened in them which makes them sacred. That does not, however, ensure their being architecture. Mr. A. S. G. Butler, in his able book *The Substance of Architecture*, quotes the case of a friend who thought the interior of the celebrated church of St. Antony at Padua a poor edition of the modern Westminster Cathedral. " Perhaps," he says, " his judgement was a little callow and his sentiment for history peculiarly small, but his regard for architecture was of the right sort because he cared solely for the thing in itself and for none of its accessories. He had compared the impressions given him by two rather similar large churches, one in Venetia and the other in London, and had formed an opinion of them *as churches*, quite unbiased by historical importance, local association or age. He had studied and walked about in both and found himself more satisfied in the modern one, and so, quite properly, this was the better architecture. For, like anything else done for the amelioration of life, the object of architecture is to give satisfaction."

It will be agreed, I think, that Mr. Butler and his friend are right. The quality of the appeal to the imagination, which turns mere building into architecture, is an æsthetic one. The building, however humble, however old, however new, however large or small, whatever its purpose may be, must make its appeal to the imagination as a thing of beauty. Beauty, however, leads one into vast fields of discussion which are out of place here. We must therefore make some assumptions, and most people not professional philosophers will make them readily enough. By beauty we must imply various qualities, and above all things the quality of unity. The building must have a general unity of conception ; the thought and imagination, that is to say, that have gone to its conception must have direction and purpose. In other words, the building must be significant, not just haphazard. Its design must be definitely organized, whether consciously or unconsciously does not matter; and organized for the particular materials used. It must be a design in those materials. The result may, of course, be ugly, for there is certainly a significance in ugliness if that ugliness has vitality and power.

Which buildings of the world make most strongly this appeal to the æsthetic imagination, which buildings, that is to say, are considered the best architecture, will vary to a certain extent from time to time, according as the individual and racial imagination varies. In every age and country racial ambitions and feelings, like the other local conditions of religion, country, climate, available materials and the varying usages of civilization, have helped to determine the forms architecture has taken. They still do to-day, but to a less degree owing to such things as the quickened means of transport, the increased use of new materials like glass and concrete which have the same qualities everywhere, and to the genuine internationalism of outlook which is growing up in all big centres and is more apparent to-day perhaps in the arts than in any other field of work. Nevertheless to understand the scope and appeal of modern architecture it is still necessary, if in less detail than heretofore, to realize the outlook and contribution of each of the great periods in those races which are, as it were, in the direct line of our descent. The batter of a wall, for instance, that is, its slope inwards, in giving a sense of immovability and permanence, must always owe something through association of ideas to the monuments of ancient Egypt. Tradition in building has been described as crystallized reasoning. Such tradition, such reasoning, that is to say, may or may not be logical and valid to-day. To discover this one must consider a little how the traditional forms came about and what were the desires and ideals to which they answered. Some of the needs, spiritual or physical, to which past architecture answered may not exist to-day but, whether that is so or not, the methods by which they were expressed have value. To judge fairly any past work of architecture these needs must be known. They are the programme which the designers had before them. Although for its final and ultimate appeal to the imagination as a piece of abstract form it may not be necessary to appreciate that programme in all its detail, it is very necessary to understand it in order to grasp the evolution of architectural forms and to see how they have changed from age to age, crystallizing on the way into what are called the styles. Only so can we hope to find our way, and judge the changes which are taking place at the present time, and discover perhaps where a like crystallization is going on. Before discussing therefore the present position and the scope of modern architecture, with its new problems and opportunities, it is necessary to see something of what each of the main periods in our line of descent has contributed to the general architectural language.

EGYPT

The first country in which we see architecture which we feel still directly and indirectly affects that of our own time is ancient Egypt. The Egyptians were a people with very marked characteristics, and they lived in a land with equally strong physical peculiarities. The life of the country is, and always has been, dependent on the Nile in a way that no other country depends on a single river. Running for several hundred miles through a comparatively narrow strip of fertile land, with desert sands or hills on either side, the Nile not only provides the means of transport but, by controlled irrigation, makes the country independent of variations of climate. The unending river and a monotonous land, largely cut off from the rest of the world, led on the one hand to a civilization which lasted with little change for four thousand years and on the other, no doubt, helped to formulate those beliefs by which not only was the life in the body considered a transitory thing and life after death of far greater importance, but the maintenance of the body itself in an unaltered state a thing of the first consideration. Hence the desire, evidenced on all sides in tombs and temples alike, to build with the utmost permanence. These indeed are the only buildings which have come down to us and, thanks largely to the dryness of the climate, in a remarkable state of preservation. If the ordinary dwelling-houses had been built as substantially, or even the palaces of the Pharaohs, some remains of them would too have lasted. The racial imagination of the Egyptians was fixed then on their tombs and religious buildings. To make the tomb or the temple permanent, impressive, mysterious, was obviously a religious necessity. To express this was the chief function of their architecture. That architecture should be functional and should derive its forms directly from the function that the building and its various parts have to serve, with as little extraneous decoration and make-believe as possible, is the great cry to-day in the revolt from traditional forms which is everywhere taking place. All the great styles of architecture are seen to exhibit this quality when the function their buildings serve is properly understood, though that function is often more complicated than it was in ancient Egypt.

To express their needs the ancient Egyptians evolved a peculiarly massive, simple style of architecture, constructed of great stones, in which the chief elements are the long unbroken wall, useful against the sun, the flat stone roof, easy to manage in a climate with little rain and no snow, the stout stone columns, connected to one another or to the walls with heavy stone lintels. The arch, though known, was not used. The dead weight of one great stone upon another was preferred to a sideway thrust making the structure depend for stability upon abutment. The pyramids, solid stone hills of sharp arresting outline in which each stone rests evenly on the one below, are the greatest example of this preference.

Mystery was obtained by a long main vista, enhanced by preparatory avenues of great sphinxes, passing next through the entrance to the temple, a small doorway between two great battering masses of similar shape called pylons, then through sunlit courts each divided by similar pylons and lined along the walls with heavy columns and lintels casting great shadows, then through a hall with a forest of closely packed columns on either side and lit only down the central avenue by small windows raised above the roof, and finally into a series of apartments, each with a floor slightly raised and a ceiling slightly lowered compared to its predecessor to increase the perspective, until absolute darkness was reached. Among these columns in the darkness and semi-darkness stood gigantic granite statues of a simplification of form and an intensity of feeling which, in those of the best periods, have never been surpassed. The columns, walls and ceilings were generally covered with incised figures and designs in low relief and brightly coloured, so that when a procession carrying lights passed through the temple strange figures of men with heads of birds and similar devices would suddenly light up. Everything therefore was done to impress the beholder gradually penetrating the temple as he walked along the central axis and passed by stages from bright sunlight to deep blackness. Along this axis there was complete unity of idea and that idea very powerfully expressed. If one walked, however, round the exterior of the temple, or viewed it from a distance from any point except on this main axis, the total form bore no such significance. One simply saw a wall breaking back at indeterminate intervals and becoming lower at each. The building therefore has not complete external unity as well as internal. That combination of excellences was to be achieved by the Greeks and then lost for centuries.

The craftsmanship of the masonry varies a great deal, as was to be expected in buildings carried out by slave labour. Much of the design and execution is crude, and the architecture as a whole is not as impressive as the sculpture. Nevertheless, the great scale which is everywhere maintained and the simplicity, grandeur and power of the main ideas which inform it, gave to Egyptian architecture a status and value which are still a measure of, and inspiration for, the expression of similar ideas where they apply to-day.

GREECE

In the buildings of the Greeks we find the same simple post and lintel construction as in those of the Egyptians, but carried so much further in expressiveness and refinement that one is justified in saying that it is now carried to perfection. Under a régime of political liberty and professional salaried labour the size of buildings, compared to those erected under the slave conditions of Egypt, had to be curtailed. But that suited the Greek ideal. To do a smaller thing perfectly was to them more important than to do a larger thing imperfectly. In their chief buildings this ideal was fostered by the material used, a homogeneous self-coloured marble of the finest quality. It was fostered too by the fact that, like the Egyptians, their chief buildings were temples and by the further fact that, unlike the Egyptians, these temples were objects to be seen, in the main, externally. They were not for congregational use. Such public services as there were took place round an altar erected in front of them. As objects to be venerated in this way rather than used their temples were set on raised sites, as the Parthenon on the Acropolis at Athens. These sites were raised, but not too much. There was not a temple for instance on the top of Lycobettus, the big mountain behind Athens. The sites were so chosen that the temple, though raised above the town as a monument, still belonged to it. This isolation of the temple affected its design. It contributed, no doubt, to its simple monumental form as well as to the refinements of its detail. The slight enlargement of the diameter of the columns at the corners of the peristyle, or encircling range of columns, to prevent their seeming thinner than the others when seen against the sky and the upward curving of the enriched lintel to prevent the appearance of sagging, are but two among a great number of similar refinements. The type of Greek temple did not greatly change. During the few hundred years in which it rose to perfection it maintained its rectangular shape in spite of the two main variations, Doric and Ionic, representing two racial streams each with their special deities. To the perfection of this single type of temple building the Greeks, lovers of order and harmony as they were, brought their capacity for logical thinking and their mathematical ability as well as the finest craftsmanship yet seen in masonry sculpture and decorative painting. They knew the value of a system of simple proportions readily to be grasped by the eye. They understood the impressiveness of large simple parts even in a small building and, by the fineness of their masonry joints, gave to their columns, made of several drums, the appearance of great monoliths. The colouring they used for a further finish no doubt helped this appearance. When a lime stone had to be used in place of marble the building was coated with a marble stucco, so that its intellectual character as a complete conception should not be interfered with by any accidental or romantic effects.

Here then were buildings once more expressing a definite set of ideas and answering very closely, as all good buildings must, to the character of their designers. They stood for perfection of proportion and finish and for an abstract, remote, almost inhuman beauty. Their broken fragments to-day are more like fragments of broken statuary than of buildings. Yet, for all this, people of a northern race, and living under cloud filled skies, are bound to feel a certain want of mystery and romance, a certain absence of imagination, that many cruder types of building possess. In a less vivid light the subtleties and refinements of Greek mouldings are lost. Certain it is that modern Greek buildings in northern latitudes—and the last hundred and fifty years have seen many attempts to create such—always appear cold and uncomfortable.

ROME

The perfection of the individual building as an isolated sculptured monument was very far from the Roman ideal. As the conquerors of the world the Romans needed a set of architectural forms which could be executed in any land and, to a great extent, by unskilled persons. Large stones for lintels not only require considerable skill in their manipulation, but were not to be found in all the places to which the empire spread. It was necessary therefore to adopt some other means of bridging from one point of support to another, and one, too, which could be carried out in small stones or even in bricks. Under these circumstances the Romans chose the semicircular arch, which their near neighbours, the Etruscans, had already used, together with its continuation, the barrel or semicircular vault. From this it was but a step to the cross vault obtained by the intersection of two equal barrel vaults or to the dome, which is the arch rotated about a centre. The great constructional advance, however, of the Romans, due in the first instance to their cement, was the application of mass concrete to these forms and on a gigantic scale. Their use of the arch as a whole, however, was rather like the Egyptian use of the lintel compared to the Greek. The Romans did not explore, that is to say, all its constructional possibilities. That was left to the designers of the Gothic period. On the other hand they wisely allowed it to influence their plan forms, which are full of graceful apses and niches softening the rectangular forms of their apartments, cloaking changes of axis and ending vistas. With their simple vaults too, especially when those vaults were constructed of mass concrete, they obtained great impressiveness. Their vast halls, now that the surface decoration has fallen from their walls and only the solid brickwork is visible together with the remains of the concrete vaulting hanging to it, are grand and moving things. As the concrete of these vaults had to be poured in a wet state on to the wooden centering, designed to hold it in place till it was set, the Romans often placed on this centering a series of boxes which, when the centering was removed, left in the surface of the concrete a series of deep recesses or coffers. This coffering, varying with the curve of the surface, was a natural and appropriate method of decorating a cast material like concrete, and, because it arose directly out of the nature of the material instead of being copied from Greek architecture like so many of their motives, was one of the most successful forms of decoration they used. For the rest they largely applied to their buildings, both externally and internally, a veneer of imitation architecture very often unrelated to the structure behind. For such purposes they formalized the types of Greek columns and lintels and added to them to form the Five Orders, or five standardized types of columns and lintels, laying down definite rules for their proportions. In this way they evolved a form of architectural decoration which, if lacking in individuality, could be carried out anywhere within the empire. This view of architecture as so much formalized scenery led nevertheless to the great forums and other formal enclosures in their towns, to the long colonnaded streets with their vistas ending on a triumphal arch or other decorative object, which have formed ever since the basis of the town-planning of the more formal parts of our cities. In the same way the relations of the great and lesser halls to each other in the Roman Thermae, arranged about two axes at right angles, with the enhancement of the vistas so formed, have been, and still are, the basis of the planning of most of our public buildings. Fortunately Roman detail usually finds its way into modern buildings by way of the Renaissance, the architects of which, especially the Italian ones, gave it a refinement unknown to the Roman originals. From all this it will be seen that Roman architecture has many affinities with modern work, which it is still influencing in every country. Some of the better of these have been pointed out, but one can go further. The great commercial buildings of to-day, while their planning has to be direct and practical like that of the Romans, are largely designed, as their Roman predecessors were, to express themselves by their grandeur rather than by their vitality. As in the Roman buildings, this grandeur is assumed like a cloak placed over a substructure of coarser stuff. The Roman *appliqué* of marbles arranged into a scenic architecture of pilasters and entablatures corresponds very closely to the make-believe architecture of columns and other classical trappings that one sees applied to-day like sugar icing to the steel frames of great blocks of offices. In both a certain make-believe takes the place of real romance and mystery. These latter are indeed the qualities that were chiefly lacking in Roman work. While Roman buildings, especially when executed in solid stone, brick or concrete and left without veneers of other materials, gave to the world a new sense of grandeur, of scale and of the relationship of one building to another, as well as a new power to roof in vast halls in a solid and impressive way, which for solemnity has not yet been surpassed, we must turn to other periods and countries to find that intimate, unfettered and individual outlook which alone can give free expression to the artist's spirit.

BYZANTINE EARLY CHRISTIAN AND ROMANESQUE ARCHITECTURE

The qualities of spirituality and intimacy which Roman architecture, in spite of or perhaps because of its grandeur, so largely lacked, found fresh life in one at least of the styles of architecture which grew out of its ashes. When the capital of the Empire was moved by Constantine to Byzantium, its buildings came more directly under Greek influence. That influence had not been absent in Rome, but there and in other parts of the empire where Greeks had been employed, they had been employed mainly as craftsmen working to other people's designs and not as originating artists. There are plenty of examples in the Roman Empire of fine craftsmanship, such as the detailing of the Maison Carrée at Nîmes, which can be attributed to such journeymen. At Byzantium, however, in the atmosphere of the East, the Greek architect as master-designer and builder comes into view and at once we have a cleaning up, as it were, of Roman building. The *appliqué* of make-believe architecture disappears, and in its place the great interior wall surfaces are decorated with a veneer of thin panels of marble and fields of gold mosaic on which float decorative motives and figures. Such columns as are used become structural again, carrying walls instead of merely enhancing vistas or supporting figures. The exterior too is left to explain itself, its solidarity being marked perhaps with alternate bands of stone and brick. Once again therefore the structure is encouraged to express itself internally and externally and the dome, its chief element, is developed into a live thing carried on pendentives (curved corbels) and semidomes instead of the heavy inert lid of mass concrete it was in Rome. We get in Byzantium some idea of what the active Greek mind would have made of the arch and its derivatives if it had applied itself to them instead of to purely post and lintel construction.

Under the influence of the East, Byzantine architecture became a field for rich and elegant surface decoration which in its turn was reflected over Europe. Strains of Byzantine influence, once not unconnected with the Crusades, spread westward, and are still doing so. Much of our modern decoration is based on Byzantine form and colour. It appears in the design and colour of fabrics, in stage scenery, in silver ware and glass. Recently not only the decorative motives but the structural ones have greatly affected church building both in England and in America. In London there is E. F. Bentley's great Westminster Cathedral, frankly Byzantine in the broad surfaces of its domed interior as well as in its decoration, and from this cathedral influences have radiated to a large section of modern church building on both sides of the Atlantic. Whenever a certain kind of emotional appeal is desired, which can be given by richness of decoration combined with spaciousness of aerial enclosure within the gracious shapes of semicircular apses, domes and arches, Europe and America still turn for inspiration to the work of the architect of Sancta Sophia in Constantinople, St. Mark's in Venice and similar buildings. Mr. Howard Robertson, in his very useful introduction to the study of architecture entitled *Architecture Explained*, considers the appeal of Byzantine motives to the emotions as the most important contribution of this Eastern architecture to that of our present times, ranking it with Greek purity and refinement and the powerful grandeur of Roman planning and mass conception.

THE ARCHITECTURE OF THE MIDDLE AGES

Before the rise of Gothic architecture in the north of France, which was to bring about a great epoch in building as far removed in feeling and expression from the previous epochs already described as it is possible to conceive, there were attempts all over Europe to emulate the great Roman halls, although the secret of making Roman cement, and consequently of Roman concrete, was lost. The types of buildings so engendered, whether they have local names like Norman, Provençal or Lombardic, are better understood under the general heading of Romanesque, as are the languages which bear very much the same relationship to classical Latin. The Roman barrel vault and dome were their inspiration, but the construction of these had to be carried out in small stones or bricks. Though a great deal of Early Christian architecture, except for its decorative motives in floor patterns and the permanent furniture of churches, is rightly classed as decadent Roman work in which the bold and essential qualities of the latter are missing, Romanesque building on the other hand is generally anything but decadent in spirit. The boldness and vast scale of great naves like that at Durham Cathedral or of the great Romanesque churches of northern Italy and southern France preclude any such idea. Still the structural requirements to uphold high in the air their great vaults made of small stones, needing either the abutment of thick Roman walls or a system of buttresses such as the fully developed Gothic cathedral possessed, were not appreciated, with the result that most of such vaults have perished. We can feel, however, from the layout of the buildings, from the size and scale of the parts, as well as from the directness of the carved ornament, the vigour of designers whose ambitions outran their constructive skill. Gradually we find the reinforcing arches, which the Romans themselves had placed within their concrete vaults and domes to hold the loose concrete while setting, reappearing in this Romanesque work, but as supporting arches crossing and strengthening the vault from below. It was probably out of an appreciation of the function of these arches and by introducing them for additional strength at every alteration in the vault surface, as where one vault intersected another, that the system of Gothic ribbed vaulting sprang up. Any structural explanation of this kind, however, let alone any decorative one, is insufficient to explain the totally different character of Gothic building. Such a change, like all fundamental changes in style as distinguished from the superficial ones dictated by fashion, could only be brought about by an equally fundamental change in the spirit, ambitions and outlook of the designers. So deep does this particular change from classical to Gothic now appear, that it can be said with some certainty that every architect to-day is born either a little Classicist or a little Gothicist ; either, that is to say, he feels in his bones that form, order and proportion in the abstract are the essence of architectural design or he feels that form and proportion, not in the abstract but proceeding from construction and materials, are the real thing. In Gothic building, construction not only took on new forms but deliberately chose those which resulted from live loads instead of dead, not, that is to say, from adding one dead load to another but from balancing one live thrust against another. It was their system of balanced thrusts which gave to Gothic buildings their dynamic and aspiring quality compared with the static dignity of Greek and Roman work. One immediate result is that height became an essential element in design. For the first time we have tall towers, buildings which pile up against the sky, vertical lines as the dominant ones instead of horizontal. As construction is the most vital element in Gothic design, the inherent architectoric quality of each building material obtains an enhanced importance. Where a Roman builder would cover the structure of his building with a veneer of another material, and articulate that in a manner unrelated to what was behind it, a Gothic one would delight in the texture and inherent qualities of the material with which he was building. Its very inequalities and accidental variations would give him pleasure and be utilized by him. When his system of vaults and buttresses became fully developed, similar accidental variations in planning, owing to the site or to some other extraneous consideration, would be turned to happy account. To make a suitable site for its temples the top of the Acropolis at Athens had to be levelled, whereas the church at the top of Mont St. Michel not only clings to the hill but seems to emphasize and express the hill itself. All this means that adventure, romance, mystery and picturesqueness are once again sought and loved. Architecture with such qualities could only come about among a virile energetic people, and it is not surprising therefore that Gothic started and grew up in the north of Europe, in lands where the sun was less intense and regular in its bounty and where Roman rule, with its mass production and its denial of freedom to the individual, was less strong. Although Gothic architecture rose with extraordinary quickness, reaching heights of heroic adventure with which there is little to compare in other styles, and although it spread over Europe, it lasted in its main manifestations only some three centuries. The particular spirit of adventure which brought it about died down and other feelings and ambitions took its place. Nevertheless it corresponds to something very deep rooted in human nature which must always be present. We may therefore always experience or expect a revival of its influence. For church building to-day it is still the recognized expression, though softened and modified by Byzantine forms and influences. All through the nineteenth century in England Gothic Revival architecture existed side by side with Greek Revival architecture, each answering, one must suppose, to different temperaments. Unfortunately, it was an archæologically-minded century, so that both sets of revivalists paid more attention to the letter than to the spirit of the style in which they were working. Mr. Charles Marriott suggests that in practice their effect on the body of architecture was compensatory. " But for the Greek Revival," he says, " we might have run to seed in pinnacles and but for the Gothic Revival we might have degenerated into stucco." With Sir Giles Scott's cathedral at Liverpool, which is still building, it is possible that a new chapter in Gothic architecture is already opening, for in it he has managed to combine not only the balance and symmetry of the classical ideal with Gothic construction but has so broadened the Gothic detail that he may be said to have clothed with new flesh the old bones of a style in which the bones generally show a great deal. It is certain that wherever construction is so loved that it provides the mainspring of design and the chief basis for the articulation of the building, the Gothic spirit will live and express itself afresh, whether in an American skyscraper or in a German ferro-concrete concert hall.

THE RENAISSANCE AND THE BAROQUE

The Renaissance was a phenomenon in all the arts which, starting with Italy, spread to every European country. In architecture it was natural that Italy should lead the way in a reaction against Gothic, for it was but a comparatively slight hold that the principles of Gothic architecture were able to obtain in a country with vast Roman remains and where the classical spirit still lingered. It was the function of the Italian Renaissance architects, however, not to bring back Roman methods of building nor, in their early work at any rate, anything corresponding to Roman architecture, but to replace the haphazardness of the mediæval town with Roman orderliness and precision. In the process the early Italian Renaissance architects, with every opportunity and temptation to do so, never became mere copyists of the antique. They invented many lovely forms and motives for which there were no Roman precedents. As has been often pointed out, there is more difference between a Renaissance church and a Roman temple than between a Roman temple and a Greek one. On the other hand it must be admitted that, even more than in the other arts, there was a strong determination to recover Roman methods both of design and construction. Once the possibility of this was realised, the remains of the Roman monuments must have produced a great effect on the imagination. With their far greater scale, if not always greater mass, than mediæval buildings, they must have seemed like the work of a race of giants no longer to be shunned, as something evil, but rather, with the striking ambition of a time which produced figures like Galileo and Christopher Columbus, to be equalled and surpassed. The serious study of Roman buildings which started with Brunelleschi and Donatello in 1403 gradually gave place however, and especially after the discovery of the works of Vitruvius and their dissemination in endless editions, to an academic interest in a rigid system of proportion for columns, cornices and all other details, which stifled real design, until it was rescued and revivified by Michel Angelo and the other leaders of the Baroque movement. The history of the Italian Renaissance, as far as architecture is concerned, is the history of a school of ordered design, infused in its early stages with a very free and happy spirit especially in its ornament, which, having received its initial impetus from the antique, set out on a new, adventurous and extremely successful career of its own, until it was overtaken and bogged by a flood of misapplied scholarship, from which the only escape was into the new and dangerous freedom of the Baroque. During the process some of the most lovely buildings of the world sprang into existence, such as the Pazzi Chapel by Brunelleschi in Florence, in which Roman forms are used with an elegance almost Greek, but retaining nevertheless the spirit of adventure which every new style exhibits at the outset. Apart from individual buildings, the great achievement of the Italian Renaissance was the formalization of the town mansion, with its tactful balance between the rights of the street and those of the individual owner and, as a sequel to this, the formalization of the street itself into a series of street façades which, while differing among themselves, yet composed into an harmonious whole. France carried this latter idea further in her long designed streets of the eighteenth and nineteenth centuries, with their continuous architecture, and England in her town squares and circuses of the same period. The highest synthesis of this kind however was reached in the early nineteenth century by the Regent Street in London of John Nash, which has unfortunately been rebuilt in recent years on commonplace lines. In the old street the buildings on either side, although in separate occupation as a series of shops and premises above, were conceived as separate compositions, each stretching from side street to side street; yet, by the similar height of the buildings and their shop facias and main cornices, but more still by all the buildings being informed with the same spirit and, though designed by different architects, designed in harmony with one another, this street reached a higher and more interesting form of street expression than any merely continuous design could achieve. It was indeed a procession of palaces, but palaces which, though differing, in a subtle way belonged to one another and to the street as a whole. Perhaps the greatest of all the gifts the Italian Renaissance gave to architecture was this civic sense which has made it possible to conceive a town, if one such has not yet been built on any scale, which is not only an organism with its separate parts and individual buildings expressing their separate functions, but one in which all such parts and structures have an hierarchic relation one to the other and are consciously designed as subordinate parts in their proper order of subordination to the conception of the whole. Sir Christopher Wren's plan for the rebuilding of London after the fire is perhaps the nearest approach on paper to such an ideal, while the cities of Washington and New Delhi are the nearest approach in reality.

Among the gifts of the Renaissance which cannot be overlooked in however short a survey is that of the Baroque. The Baroque was the expression of a new spirit in architecture, a spirit of self-dramatization, of adopting a definite pose and swagger, not, as it were, wholly believed in by the actors. Its products must not be confused with the massive grandeur of Roman work on the one hand or the trumpery glitter of the *rococo*, a small scale degeneration of it, on the other. Although a great deal of Roman architecture was scenic architecture, it was not necessarily dramatic. The Baroque, however, always is. Its grandeur lies in the ideas expressed rather than in the materials used, which were often poor enough. It came about as a reaction to the academic architecture of the Vitruvian and similar rules and it obviously answered to a universal craving, for it quickly spread to all European lands. In so doing it often overtook the more sober forms of the Renaissance, so that in some countries, such as Germany and England, it is found mixed up with a tentative use of the Orders, that is to say before even the ideas of classical architecture had been clearly grasped. The invention of printing and wood block engraving, by enabling ideas and motives to travel at a rapid rate, had a good deal to do with this. The travels of Italian artists about Europe had much the same result. In France, for instance, we find in the time of Henri Quatre strong Roman exteriors with rich Baroque interiors. In England, largely cut off by the Reformation from direct contact with Italy and obtaining her knowledge of the new movement secondhand from Germany and the Low Countries, we find in Elizabethan and Jacobean architecture a strong mixture of the Baroque in buildings still Gothic in structure.

The Baroque architect conceives his building as so much plastic material, to be modelled very much as a sculptor does his lump of clay. Though the structure has to have its apartments and staircases like any other building, these are quickly given, by means of sweeping curves, a definite relation to the movement of the whole. In spite of the horror with which the Baroque was viewed in the last century, it can be readily seen that its buildings obey a law of their own, in which every part is subservient to the total dramatic effect. They possess therefore, often to a very high degree, the quality of unity so necessary to a work of art. Any building in which display was part of the programme easily fell within their scope. Palaces for the parade life of princes were particularly adapted to it, as were churches when worship took the form of high ceremonial. Gardens too became a favourite field for the baroque architect, for Nature herself, especially in a semi-tropical country, often falls in with the mood.

The chief value of the Baroque to-day is that it provides a contrast to the hard lines of modern building based on steel construction. It can provide many happy incidents in the long lines of streets, as the Baroque fountains do in Vienna. With life daily becoming more and more mechanical, the happy free spirit of the Baroque, careless of conventions and proprieties and even of the obvious laws of construction, provides a welcome release for the human spirit. While a large Baroque town might be a nightmare, Baroque incidents in towns can be as delightful as a Chelsea china figure on a stiff marble mantelpiece.

While every nation produced its variants of early and central Renaissance architecture, as well as of academic classic and the Baroque, which it is not necessary to follow here, a word must be added about the French forms. France, in spite of her starting the great Gothic stream of building and developing its constructive possibilities to their highest pitch, was the quickest after Italy to adopt the ordered architecture of the Renaissance, and at once gave it a peculiar and national significance. The movement in France began with the châteaux of the King and the great nobles, that is with buildings either in the country or in small towns where they stood up high above their surroundings. In such buildings, in contrast to the urban palaces of Italy to be seen in narrow streets, the roofs of these châteaux outlined against broad landscapes or across whole towns naturally played a great part in the composition. It was for this reason perhaps that the architecture of French Renaissance buildings relied more on the masses of the building, the grouping that is to say of the various pavilions, than on the paraphernalia of the columns either free standing in portico or colonnade. This again is reflected in the plans. The French Renaissance architects were far quicker even than the Italians to see and adopt for their own purposes the elegances of Roman planning. They may be said to have done for Roman plan forms what the Italians did for Roman elevations, that is to say, they edited them for the modern world, while adding elegances and refinements undreamt of by their originators. Whereas other countries, such as England and Holland, have given a homely turn to Roman architecture, reducing it as it were to the domestic level, it has been the province of France to develop logically the broad spaciousness of Roman planning and, at the same time, to invent for such plans an elevational treatment which, if based on the Roman Orders, was not only suited to her climate but was decked with the peculiar elegance her designers are always able to achieve.

GENERAL PRINCIPLES OF DESIGN

There are certain general principles of design, in the main very simple, which can be applied as criteria to the design of any building. If such principles, however, covered the whole ground, there would be no such thing as the art of architecture but only the science of architecture, and every man or woman could by industry become an architect. We know that that is not so, and that the intentions of the artist go in many directions much further than the deductions of the man of science; even in the higher realms of the latter there seems to-day a considerable tendency to adopt the artist's methods. It is possible, however, as in music and indeed all the arts, to lay down certain general rules as guiding principles, with regard to architectural expression, remembering that in every art the genius will in time break them all in favour of some wider generalization and that he will then—or more probably a century later—be rightly applauded for so doing.

The first general principle is the maintenance of unity in any design.

There must be a dominant mass or feature holding the various parts of the design together, as the church tower does the English village. If a design has two equal masses, like the twin towers at the west front of Notre Dame in Paris, those towers must either be bound together so that they become complementary parts of one mass or they must be dominated by a third mass in the way the central tower of Durham Cathedral, from certain points of view, dominates the two western ones. We have seen that the Greeks set immense store on the principle of unity, giving it their chief attention in the development of their temples, which however, as a rule, consisted of simply shaped single masses. Their problem was not to take two or more masses and so vary and model them that they combined satisfactorily into one whole, but so to relate the parts of a single mass that each contributed to and intensified the expression of the whole. If we examine in detail any part of a Greek temple we find no unresolved duality anywhere. The front, for instance—although there is an equal number of columns on either side of the central axis, these columns are united and held together by the strong entablature and the climax of the triangular pediment above. It may be suggested that this is not the case with the side, but the side is meant to lead up to and to be read with the front. This principle of unity applies likewise to all floating or semi-independent portions of a design, such as doors and windows in themselves. If a door has four panels, either the upper pair or the lower should be the taller. Four panels in pairs, one above the other of equal length, would make a very tiresome door. We all know how unpleasant a sash window looks if the sashes are of equal height and there are no other division bars. If, however, there are division bars so that the window consists, say, of eight panes to each sash, the duality disappears in the pattern of the sixteen panes as a whole. Inigo Jones's well known Banqueting Hall in Whitehall is a building which appears, on looking at it carefully, to consist of two equal storeys of windows, each between a range of columns of nearly equal height. The fact that most of us do not feel any difficulty about this, or even notice it at first glance, is due to the way in which the architect has given dominance to the upper storey by the frieze of heavy wreaths between the capitals of the columns and to the height to which he has raised his balustrade. Most architects unconsciously and easily avoid duality in their main masses, though it often creeps in with the minor detail. A pair of gate piers, for instance, with an iron gate between them, would provide a case of unpleasant duality if on the far side of each pier were iron railings of a similar height and design to the gate. The piers would then stand out as a definite pair of identical things. If, instead of the iron railings, there was a brick wall on the far side of each pier, the iron gate itself would make a third feature, binding together the other two and in that way producing the necessary unity. The clock tower between the two great arches of King's Cross Station in London serves this purpose, though it would serve it better if it were still more dominant.

The next general principle is punctuation (to adopt the classification of Mr. Trystan Edwards, who has written more incisively on the theory of formal design than anyone else). By this is meant that every element not serving as a link between others must have its terminations emphasized.

The obvious example of this is a column with its well-marked base and capital. Without these there would seem to be no reason why the column should be of any particular height. It may be replied that the Greek Doric column has no base, but the answer to that is that it always stood on the strongly-marked, horizontal lines of steps and that these served as a base. If the Greeks had used it standing free as a pedestal for a figure, as the Romans often used their columns, it would probably have been given some feature which would have served that purpose. The other exception which jumps to the mind is the columns of the Doge's Palace at Venice, but these have the definite appearance, probably intentional, of sinking into the ground. They suggest the piles on which the building is built. One of the well-known ways of punctuating the base of a building is to stand it on a series of columns which, contrasting with the horizontal lines of the wall above or of the pavement below, give to the base of the wall a very strong emphasis. It will be clear, however, apart from these exceptional cases, if they are that, that definition of outline is obviously a desirable quality in any design in the solid. One must know and feel where a wall, a tower, or roof ends, to form a satisfactory impression of the total design in one's mind. The apparently unfinished and certainly unpunctuated tops of the mediæval towers, which crowd the little hill town of St. Gimignano near Sienna, give one a sense of incompleteness, as if the town had just been sacked and the towers broken off. The thickening of the base of a wall and the marking of that thickening on the exterior with plinths, mouldings and the like seem an obvious thing to do, but a great deal of the satisfaction provided by a fine monumental wall, like those of the Florentine palaces, comes from such punctuation. In such palaces, and in others in Italy, the emphasis of the base is often increased by moulding it into a stone seat running the full length of the façade. The top of the wall is also strongly marked, either by the overhang of the roof, by the cornice which derives from it, or by some setting in of the parapet which emphasizes the fact that the wall is as high as this and no higher. In some modern German designs it is the fashion at the moment to cut off the wall of a great building sharp at the top without anything to mark the finish, and unless there is, as is usually the case, a topmost range of windows of different design from those below which serves the same purpose, the result is very crude. There seems indeed no reason why the building should not have another half-dozen storeys. In the more formal buildings of the Italian Renaissance the punctuation of the wall was carried very much further. Not only was each storey marked with a string course or band, thickening the wall where wall plates to receive the floor were inserted at the back, but the surface of the stone was varied from storey to storey, starting with the roughest quarry-faced stones and ending with a smooth surface of evenly cut stones to reflect, as it were, the glories of the great cornice immediately above it. In addition, these various stages of the wall were given vitality and interest by variety in the depths of the courses and lengths of the stones. Quoins, or alternate long and short stones, in the same way, define and punctuate the horizontal limits of a wall. That is why they are generally left out in a street front abutting on others as too unneighbourly an assertion of private rights. The continuity of the wall surface from building to building, which was so common in the eighteenth century streets, was a gentlemanly admission that the street had its claims as well as the individual.

The third general principle is called by Mr. Trystan Edwards " the canon of inflection." It is the principle which governs the relation of the parts of a building to the whole and the relation of the whole to what lies outside. Punctuation, it will be seen at once, is but a special form of inflection in which an object takes cognizance of its boundaries. The western towers of St. Paul's Cathedral are punctuated very elaborately, the curved features at the top contrasting strongly with the vertical and horizontal lines below. They are, however, inflected as well to contrast with the dome. Their very elaboration, as well as their elongated shape, both pay deference to the great simple swelling curves of the latter. It has often been suggested that the thin lead spire of Wren's Church in Ludgate Hill, which from the base of the hill is seen against the cathedral, received from him its needle-like shape to throw up the mass of the great cathedral. The preparation every good building makes for every large feature is an obvious but important form of inflection. Most domed buildings like St. Paul's or St. Peter's (as originally designed) have a projecting portico or similar feature without which the dome would seem not to belong to the substructure, which is another way of saying the substructure has been inflected in deference to the dome. The frieze to a Greek Doric temple, with its alternate strongly marked vertical lines and carved panels, prepares the eye for the richness of the figures in the pediment, while the slight projections immediately under these vertical lines modify the plain strength of the lintel and make preparation for the frieze. One often hears the criticism that a feature of a building seems "stuck on," and there may be a proper basis for such criticism. It may be that the building in question has not been sufficiently inflected to lead one to expect the feature complained of.

The net result of all this is that inflection is the safeguard against crudity. It applies, if in a lesser degree, between the building and its neighbours, or should in a fully civilized town, as it does between one part of a building and another or one section of a moulding and the next. In a street it should regulate the attitude of one building not only to the next but to the whole street and, in an ideal town, of each building to the whole. There is no doubt that in periods of high civic manners something of the kind took place. Sir William Chambers apparently took care that the dome over the central feature of the river front of Somerset House in London did not rise to a height which would make it challenge the dome of St. Paul's, and in a time of less civic manners the architect of the Central Criminal Court in the Old Bailey in the same town did not take the same precaution. Sir William Chambers's courtesy, it is pleasant to think, was repaid to his own building when James Rennie, the designer of Waterloo Bridge, took pains that its long horizontal line should coincide, instead of conflicting, with that of the terrace of Somerset House.

It is needless to say that the principles already enumerated apply equally to the plan of a building. Assuming a plan has satisfied the practical requirements, the æsthetic judgement one passes on it must be based on considerations similar to those applied to the exterior. Has it unity? Do the apartments bear a definite and not haphazard relation to one another ? Do the vistas end adequately and not just peter out ? These considerations do not of course preclude the element of surprise and contrast. Contrast is just as much an inflection as adjustment and preparation.

There are two other rather difficult things which must be referred to in this section. They are proportion and scale—both, however, things which cannot be definitely explained. Though they are obviously part of the method of inflecting a building, they are governed so much by the idiosyncrasy of the designer that no general rules can be laid down. A great modern architect, whom all respect, when asked what was good proportion replied laconically " God." What is good proportion to one man will not be so good to another. It is safe however to say this, that by maintaining a system of similar proportions throughout a building, say the same ratios of height to width in all openings, and by setting out one's building on a system of unit spacing, a sense of unity and power is fostered, until of course one wishes to break it for some dramatic effect. All attempts however to express architecture in terms of mathematics come to grief somewhere or other. Generally the ratios quoted are either too simple or too recondite to satisfy the æsthetic sense. There seems too within such limits to be no reason why any particular ratio should have more virtue than any other, except perhaps to a particular individual. The only constant element in the proportions of a building is the height and shape of the human figure. Doors and windows have, for instance, a direct relation to the human figure and consequently their proportions have a psychological reaction. A wider doorway than usual, such as that of a double door, at once suggests spaciousness, whereas a very narrow doorway, through which a man can barely squeeze, suggests cramped, prison-like quarters. Such questions are mixed up with that of scale, or the relative size of the parts of a building, to which short reference must be made.

It is important for good design that a building should look its size—a large building large and a small building small. The architect therefore introduces into his design doors, windows and other elements, related to the human figures, of such a size that the beholder has some means of measuring the size of the building. He might make an isolated building look twice its size if he halved the size of such features, but directly a human being approached this false size would be exploded. Within limits, however, he can do a great deal to give the character he desires to his building by altering the scale of such parts. The great door to an Italian palazzo at once seems to suggest that the owner is a fine fellow with fine apartments in his house, an effect to which the wide spacing of the windows gives further colour. Having once set the scale of a building, that is to say the air with which it should carry itself, it is highly important that this scale should be preserved in all important parts. A fine brave front to a public building must not sink, even in a key block or a single piece of ornament, to the scale suitable to similar features in a small domestic building, while even more obviously the reverse is the case. To maintain the same scale throughout a building, until one comes to a set of *petits appartements* or to a chapel or chantry purposely and obviously of another scale, is but to express another aspect of the necessary unity. A building designed on one scale cannot be reproduced on another and be successful in both. The attempt in the cathedral at Montreal to make a reduced St. Peter's at Rome is an obvious failure, in spite of the abnormal scale of the latter. Scale, like proportion, is an instrument in the hands of the designer to obtain certain effects. By contrasting one thing of recognizable size with another the scale of that other may be forced up or down. The posterns within the great doors of a cathedral give a sense of size to the latter, and these in their turn to that of the porches in which the doors are set. These porches again form a foil to the west front and so on. The one thing however which is certain in regard to the scale of buildings is that the Scottish proverb " Many a mickle makes a muckle " is not true. A large number of small parts may together make a big building but, unless by inflection the whole has unity and scale, the building, however big, will lack the power to affect the imagination which a building a quarter the size with larger parts may possess. One has only to think of numberless examples of the modern apartment house or block of flats to realise that this is so.

In addition to those already discussed, there are two more general qualities in a building which should be mentioned. A building, like any other work of art, must have character in the general sense answering to the nobility of mind and intention or otherwise on the part of its designer, as well as to the idiosyncrasies of his personality. It differs, however, from a painting or piece of sculpture in that it must have functional character as well. Now functional character is of two kinds, first and foremost the character which a building or any part of it gets from its form being dictated by its function, that is to say by the practical purpose it serves, and secondly by the traditional form with which such a purpose is associated. When we say of a church that we like it because it looks like a church we are, generally speaking, being influenced by traditional form. When, however, we admire a grain elevator with its row of powerful concrete containers and say it has character, we mean that the mechanical function the elevator performs has been clearly expressed. Most buildings make use of both forms of expression, that is to say, their character is emphasized both by associated ideas and by a general truthfulness to the functions they serve. The modernists however, who attempt to throw over all traditional forms, rely entirely on the latter. To them anything beyond that is sentimental and false. Each section of their buildings and its function should be marked on the exteriors. Windows, for instance, take a long horizontal shape if that is the best shape to light a particular apartment, regardless of the pattern they are making on the exterior. This is not the method of nature with the human figure. Though that figure can be made to express an infinite variety of character with admirable clearness, the separate functions of the various minor organs do not receive, fortunately, separate expression. However, for those whose worthy ambition it is, with the aid of new materials and new methods of construction, to use less and less of the traditional forms in order to bring about an architecture more expressive of our times and purposes, it is an excellent beginning to allow their designs in the first instance to be regulated by function, for we may be sure, however crude the first results may be, there will be by this method no pompous or unnecessary decoration and no inherent vulgarity.

Modern architects in their daily practice may roughly be divided into four schools : (1) the Classicists, (2) the Gothicists, (3) the Eclectics, (4) the Modernists. That most of them would deny that their own work falls into one or other of these categories is a good sign, which nevertheless does not prevent it from being a fact. Let us take each division in turn.

The Classicists are those architects by whom the love of ordered abstract form is deeply felt. They are the inheritors of the Roman and Renaissance ideals and in a modern world, governed by law and with order prescribed on every hand, they are bound to exist in large numbers and to find constant employment. They are likely to include in their ranks official architects of every kind, who by the nature of their employment are little given to taking risks. In the eighteenth century and the early part of the nineteenth they were supreme in all European countries and in America. The romantic revival however before the end of the eighteenth century had already produced an affected form of Gothic, of which Walpole's Strawberry Hill villa is the stock example. Even before that there had been those world-wide bursts of pent-up energy and the sharp struggles to break free from the restraint of the rules of classical architecture, which the baroque and rococo movements in design represented. The course of classical architecture had indeed never been a continuous or consistent one. The first half of the eighteenth century, with its comparatively settled social order, was its great flowering time both in England and France. The ordered arrangement of the windows of the Georgian or Colonial house, whether in town or country, seems to express exactly the best qualities of combined refinement and dignity which that century offered to the more fortunate. With the rise of the manufacturing classes and their individualistic outlook these qualities rapidly broke down. The whole hierarchic system of country town or village, which in the eighteenth century produced a cousinship between the small Georgian house of the professional man or successful tradesman and the classical mansion of the squire, gave place in the nineteenth century, especially in the northern industrial towns of England, to the overgrown and overdecorated villas of the manufacturers on the outskirts of the town and to the rows of mean little boxes for his employees within the town itself. Beyond this there was no real link between their types of architecture, if that term can be extended to either. The manufacturer as an individualist, little conscious of the appeals of culture or even the dictates of fashion, began to house himself according to his fancy, and when the Gothic Revival starting in another field loosened the bands of tradition even for the cultured, he was ready for any experiment in plate glass, Gothic tracery and terra cotta which came along. The result on the architecture of the nineteenth century was chaos on the one hand and two ever hardening schools, one of Classicists and the other of Gothicists, on the other. With the former this naturally tended to a revival of Greek forms. The Bank or Baptist Chapel in England, the Law Courts building or State Treasury in America, assumed the portico, if not the complete peristyle, of a Greek temple. In France

Napoleon, assessing the competitive plans for the Madeleine in his carriage during the retreat from Moscow, in order one hopes to distract both his eyes and his thoughts, awarded the prize to a great temple structure. The next phase, generally called the Neo Grec, was probably due to the indirect influence of the Gothic revivalists. The restricted if high ideal of the Greek temple was naturally found insufficient for all modern purposes. The Gothic revivalists were offering freedom of plan and outline to their devotees. Perhaps the Greek revivalists felt the influence of this freedom. The result, at any rate, was the production of buildings like Duc's Palais de Justice in Paris and Cockerell's buildings in England, in which the architects felt they were free to use all the Greek and post-Greek motives, Roman and Renaissance, and blend them together. In the hands of great artists like these, their knowledge and taste were sufficient curb on their imagination, and powerful and expressive buildings resulted. In lesser hands this freedom meant the luxuriant ornateness of the Paris Opera House. In Scotland it produced free scenic compositions like Thomas Hamilton's Edinburgh High School or, where the same architect added Renaissance motives, so fine a block as that of the Royal College of Physicians in Queen Street in the same town. The climax of the whole movement may be said to be the great Græco-Roman building of St. George's Hall, Liverpool, begun by Harvey Lonsdale Elmes and finished by C. R. Cockerell, in the exterior of which, although far more complex than the simple Greek temple, there are no motives to which the greatest classical purist could object, while even the Gothicist must admit that it not only admirably expresses its purpose—a great covered forum for the town—but also truthfully explains the main divisions of its plan.

After St. George's Hall in England and Schinkel's Museum in Berlin, the building which most nearly approaches to it, the classical movement gradually gave way before that of the Gothicists, till it was revived at the end of the century, chiefly by the great designing firm of McKim, Mead & White in America and by Norman Shaw and E. C. Rickards in England. The former first awakened America to the scenic grandeur of classical architecture by its work at the World's Fair at Chicago, the international exhibition of 1893. This firm gave to New York and Boston buildings based on Roman and Italian inspiration, such as Pennsylvania Railway Station, the University Club and the Pierpont Morgan Library in the former and the Public Library in the latter, and these seemed at once to put America abreast of Europe in scholarship and distinction. By working in a Roman manner rather than in an English or French, these architects gave modern American architecture a central position from which it could develop in any direction. To have brought the architectural thought of their country to this eminently sane position after the vagaries of the Gothic Revival, as practised there and after the vogue of Richardson's Romanesque, was a great achievement, even if it was brought about by more faithful copying of past forms than most architects would care to adopt to-day. McKim himself, the leader of the firm, justified this by explaining that America, with no great monuments of antiquity to set up a standard of taste and finish, required such buildings in her midst, and to judge from the results which followed, especially in the very high standard of detail to-day, whatever may be thought of the general composition, he was amply justified. In a country too where so much detail is standardized the importance of this can hardly be overrated.

In England the result of Norman Shaw's and E. C. Rickards's influence was rather different. The former was a domestic architect who gradually turned to classical forms in his old age, when great monumental buildings came his way. Having rescued English domestic architecture from the hard hands of the Gothic revivalists he brought it through a Queen Anne phase to a Georgian one, leaving behind him in the suburbs, unfortunately, many sad imitations by those who tried without sufficient knowledge to walk in his footsteps. Nevertheless his classical buildings still remained semi-picturesque. Sir Christopher Wren and his Dutch contemporaries were Shaw's chief inspiration, with the result that to-day in England Wren, Vanbrugh and the early classical architects, rather than Chambers, Adam and the later ones, have the chief influence among the classical school. Rickards's work pulled in the same direction but with a very strong leaning to the Baroque, of which difficult form of expression he proved himself the only modern English master. To the Wren school of English Classicists, that is to those who would temper the severity of classical building with a certain amount of picturesqueness of outline and modelling as well as with domestic softness in materials and craftsmanship, must be added the name of Sir Edwin Lutyens, by far the most powerful personal influence in this school to-day. Like Norman Shaw, Sir Edwin has passed from being the leading domestic architect of his time to be the builder of vast banks and commercial buildings, of the great palace at New Delhi, rivalling Versailles in size but with the lovableness of Wren's Hampton Court, and of the great Roman Catholic Cathedral at Liverpool. In all these latter, as was fast happening with his later domestic work, he has become a classical architect. Unlike so many however he has never lost the individuality of his touch, that is to say, he has never allowed himself to be mastered either by the Vitruvian rules of the Orders or by the general fashion of the time. Whereas the mass of post-classical architecture in England during the last thirty years, especially in town halls, banks, insurance offices and the like, has lacked distinction, too little study having been given to the details of the façades in comparison to the more obvious practical points of the plan—a result probably of the competitive methods by which the architects are so often selected—so that the work has at once an over rich and yet a tired appearance, Sir Edwin's buildings in contrast are always fresh and full of invention. No man is less tied by precedents, though no man knows them better. It is interesting to notice that, while giving this strong individuality to his buildings, he always designs them on a system of units and fixed proportions. Although strictly classical architecture seems everywhere to be dying, and not least where it is applied to a steel framed substructure, Sir Edwin, who so far has never made his external walls entirely dependent on such a frame, seems to be the one architect left who can still give it life and vitality. The architectural world waits with no little eagerness to see how the Roman forms he has chosen for his great cathedral at Liverpool, second only to St. Peter's at Rome in size, will live again in his hands. What seems certain is that, but for inventiveness controlled by good taste such as he and certain modern Swedish architects like Ivar Tengbom have shown, the steel or reinforced concrete substructure would by now have everywhere broken through and mastered the appearance of the bigger buildings, as it is already beginning to do in Germany and America.

In France and Germany after the classical period of porticoes and peristyles, which was never so pronounced as the corresponding Greek Revival period in England, there was (as has already been mentioned in the case of France) a period of Neo Grec work, when the classical and post-classical motives were mixed together with a certain freedom. After that, though in neither country was there as strong a Gothic Revival as in England, both went through a series of experiments in various forms of Renaissance expression, but keeping, especially in France, to that system of Roman planning in the form known by and produced under the ægis of the Ecole des Beaux Arts. This system, based on a logic which lays emphasis on the chief apartments and then builds round them the plan and circulation of the building with a series of graceful Roman shapes, made no attempt, beyond the control which plan forms must always have over the modelling of buildings, to determine the expression of the elevations. When therefore a fashion for new forms and ornament, called *L'Art Nouveau*, started in Glasgow and travelled to Vienna, where it was developed to a certain consistency by the Viennese architect, Otto Wagner, and spread back to Paris, it was adopted there for a time under the free system of modelling which the Beaux Arts plan allowed. Being however but a series of decorative forms with no logical basis of structure behind them, and owing its existence mainly to a desire to break away from traditional forms, the fashion soon died a natural death. The fact of its appearance at all, however, and of the rate at which it spread across France and Germany proves the tenuousness of the hold classical architecture had even in those days before the development of either steel frame construction or of ferro-concrete. All great changes of style have coincided with the new use or discovery of a building material. It is these two materials steel and ferro-concrete, new to building operations on a large scale, which to-day threaten to alter to an unprecedented degree all modern architecture, sweeping away alike both the Classical and Gothic methods. Before however referring to the problems they are causing, it is necessary to say something about the Gothicists.

The Gothic Revivalists of last century were a band of enthusiastic architects and laymen who mixed religion and art in a way which, if it seems a little ridiculous to-day, represented something very real to them. Regardless of historical accuracy we find Gothic architecture described as Christian architecture and advocated as such on ethical grounds with truly missionary fervour. This, naturally enough, led to the worship of the letter rather than the spirit of the style. The curious thing is that, in spite of this, during the fifty years of its ascendency we find the exact phase of Gothic architecture to be followed by the elect always varying. Sometimes the only pure style of Christian art is said to be that of the last half of the thirteenth century, sometimes that of the first half of the fourteenth. This was unfortunate, especially when it meant restoring buildings, great cathedrals as well as parish churches, to the right half century by rebuilding the delinquent parts. A great deal of beautiful and irreplaceable mediæval craftsmanship and architecture was thereby destroyed. Architects who were genuine artists, however, could not for long submit to having their freedom fettered in this way, and in the last quarter of the nineteenth century there grew up a school of church architects who, ceasing to be archæologists, sought to achieve the spirit of mediæval architecture rather than to copy its earlier manifestations. This, under modern conditions, led to a broadening and simplification of the style till in recent Gothic buildings, like Sir Giles Scott's Liverpool Cathedral, as has already been pointed out, and in the Högalid Church in Stockholm by Tengbom, the influence of the classical spirit of static beauty can be felt as well as the more dynamic spirit of Gothic. This broader treatment of Gothic, while it reduces the opportunities for individual craftsmanship, meets the conditions of to-day where design of every detail has to fall into the architect's hands owing to the absence of men so imbued with the Gothic spirit that they can themselves not only carry out their craft but think and design in its material.

Although classical forms of expression and Gothic ones must always be poles asunder, there is nevertheless no doubt about the influence of the spirit of each upon the other. We have noted the influence of the classical on modern Gothic architecture. It remains to point out the converse, which is perhaps the most valuable legacy Gothic architecture has given the modern architect. This influence is shown chiefly in two things, firstly, in an enhanced appreciation of the value of construction itself as a means of architectural expression, and secondly in the expressive value of the innate qualities of building materials. Taking the second of these influences first we may trace to it, I think, a great deal of the charm possessed by the domestic architecture of most countries, and especially of England. It is largely due to it that the smaller domestic buildings, when erected of local materials and with local craftsmanship, seem to belong to the countryside almost as works of nature. The old cottages of North Wales, built of big rough stones and roofed with small rough Welsh slates, grow as naturally out of the hills as if they had always been there. Even in the more formal building of the Georgian epoch in England the domestic buildings owe a great deal of their appeal to the varying colour of the bricks, to the contrast for instance of red quoins and arches with the rich brown and purples of the main walling. When the classical spirit gained a further hold such houses, to increase their formality, were often stuccoed over and the colours and textures of the brickwork were lost. One might almost say that the nearer a material approximates to the uniformity and purity of the marble of the Greeks, the less of the Gothic spirit can that material exhibit, yet to find the exact form of expression to make the most of that marble would have been as much a Gothic ambition as it was a Greek. It would be the Gothic spirit which would prevent a classical architect to-day from varnishing or polishing a wood like oak with its rough grain and open pores. It is the Gothic spirit that makes every architect who is building in the country study not only the local materials and methods of craftsmanship before he designs his building, but the shapes best suited to the landscape.

More important, however, than the Gothic contribution of the value set to-day on craftsmanship and the use of materials to bring out their inherent qualities, is the stress it has taught us to lay on the expression of construction. Making a building truthful to the general principles of its construction does not mean that every floor joist and timber (even if of oak) must be exposed, any more than it is necessary to express on the exterior every lavatory and unimportant department of the plan. It means that in the main forms there must be no secret diplomacy of construction going forward. Wren's hidden brick cone carrying the stone lantern above the exterior wooden dome of St. Paul's Cathedral is the sort of thing a modern architect imbued with the Gothic reverence for construction could not commit, and is indeed a thing with which it is difficult for any one to be comfortable once it is realized. This reverence has given to-day added impetus to the modern movement for a new form of architectural expression largely corresponding to the constructural uses of the three new modern materials steel, concrete and glass. With it therefore we should reach our fourth division, the Modernists, but we must dispose of the Eclectics first.

Among modern architects the Eclectics are probably the largest of our four groups, but they are nevertheless and naturally the group with the least influence. They are of course the people who are prepared to experiment in any style, having few convictions and little in themselves to contribute beyond scholarship. They exist in larger numbers in America than in Europe, because with the roots of her architecture to a great extent in other countries and with a vast area producing every variety of climate and landscape, her architects have greater excuse or reason for experimenting in various methods of expression. Apart from their own very distinctive tall buildings, to be dealt with directly, their grain elevators and similar structures where they have had to break new ground, it would be safe to say that the mass of their modern architecture is more derivative than that of most European countries. One finds Tudor, Elizabethan, Jacobean and half timbered houses, Italian villas, French châteaux, Mexican farm buildings, and Spanish Mission buildings pretty evenly distributed throughout the country, though California on one side and Florida on the other have more wisely specialized in Spanish architecture. Unfortunately too, easy transport has to a large extent abolished the compulsion to use local materials, so that Indiana lime stone and Vermont slates, oak floors and windows from the south, or brick facing from Ohio, are far too widely distributed for the encouragement of local character. It must be admitted, however, that this decorative eclectic building is much better done as regards the scholarship of its detail than it was in England in the pre-War days, when to a lesser extent it was indulged in there. The American architect who is to build a Tudor or Elizabethan house to-day, not having the buildings to refer to, makes use of the books of measured drawings and photographs (which have now been published of every period in every country) and gets his detail right. It would often be better if he did not succeed in this quite so cleverly and relied more on his own invention and judgement. Building in fancy dress, however archæologically correct, except as a training in craftsmanship, does, in the end, far more harm than good, and it is satisfactory to note that such building is less in evidence now than ten years ago, just as the fashion for period rooms in hotels and liners is gradually giving way to rooms designed to give similar atmospheres but achieved by choice of materials, by pattern and by ornament which are deliberately non-archæological. However, with this we again reach the Modernists.

Before the late War a movement had started in all the arts to break away from traditional forms of expression. They were felt by many to be out-worn. In painting and sculpture this took the guise of a revolt from realism in order to express more intense feeling. Architecture being in any case a non-representational art, the revolt showed itself in a desire to express more directly both the purpose of the building and the part played by its construction. " Fitness for purpose " became almost a slogan in certain architectural circles, the purpose being interpreted as the mechanical purpose of the building, not its appeal to the imagination : that would, it was considered, look after itself. Since the War the rapid development of the motor-car and the aeroplane have greatly strengthened this school of thought. These are held up to-day, especially the latter in the form of racing machines designed for the single purpose of speed such as the Schneider Cup flying boats, as examples of the beauty which can be brought about by perfect efficiency. There is little doubt about this beauty as far as it goes, but whether it is the full content of the beauty that architecture can provide is another matter.

THE MODERN MOVEMENT IN AMERICA

In America, before the War, the steel frame to carry the building had made possible the tall tower or sky-scraper, which the electric elevator, with its power of making vertical travel more speedy than horizontal, had made desirable. A well-known American architect has stated that thanks to its system of tall buildings a business man can pay five times as many calls in the morning in New York as he can in London or Paris. The concentration of population within the narrow limits of Manhattan Island no doubt helped to force these buildings skywards, but that they have appeared in considerable numbers in Chicago, where no such pressure exists, and are being erected in many other towns, proves that they possess in themselves an economic value. Recently they have almost doubled in height by the mere discovery that it is possible to run two elevators in the same shaft, one serving the upper and the other the lower portion of the building. From averaging round about 500 feet they are now being built round about 1,000 feet high.

It is interesting to note how this increase of height has been dealt with architecturally. When buildings first began to exceed the five or six storeys of the Old World, the Old World motives were merely stretched to accommodate them. In the Gorham Building in Fifth Avenue, with its dozen storeys, the classical form of cornice still remains, although it can no longer be proportioned to an imaginary column applied to the front of the building, nor can it serve constructionally to protect more than a small part of the upper portion of the walls. Even so, the increased overhang required to prevent it seeming ridiculously small led to cornices being cast in light hollow metal and painted to look like stone, instead of being the stone oversailing courses they pretend to be. One saw whole lengths of such cornice, apparently ready carved, being hoisted up the fronts of buildings. This ridiculous position could not last very long. As buildings grew taller and lost all likeness to the proportions of the Italian palace, the Italian methods of façade design had to be thrown over. The next step was to try a stone *appliqué* of Gothic detail to the steel frame. The Woolworth Building in New York belongs to this period, just preceding the War. This, at any rate, gave prominence to the vertical lines of the steel, which in these high buildings are obviously the more significant. It led however to pinnacles, cathedral-like roof, niches, canopies, and other Gothic paraphernalia, which meant little or nothing, but gave a general ecclesiastical air inside and out which was rather unpleasant to those who associated the forms used with other purposes. The name " Cathedral of Commerce," adopted as an advertisement, only emphasized this unpleasantness. It must be admitted however that this tower building, with its vertical grouping of the windows and generally soaring lines, was a great improvement on its predecessors and pointed the way to the happier solutions which were to follow the War. It remained far in advance of other tower buildings, some of which followed it in point of date, in which, though the classical features were no longer stretched out over the whole building, they appeared at the base to punctuate that part and again at the top for the same purpose, leaving a tall plain shaft in between of indeterminate height. The punctuation at the top sometimes took the form of a small temple or other classical composition sitting like St. Simon Stylites on his column high above the town, while that at the base made an ordinary classical façade in scale with the street and decorating that part of the structure which could readily be seen from the street level.

In the meantime New York had adopted a legal enactment called the Zoning Law, regulating the height of buildings, which was to have a great effect not only on the parts of the building coming within its restrictions and on the tower section which was left free to run up to any height, but on the general form of big buildings in America. Briefly the law was that on a quarter of any site the owner was free to build a tower of any height. On the remainder, he could only build facing the streets to some definite ratio of the width of the streets, this ratio being determined by the district. This meant that in certain districts down town the first cliff front of the building to the street might be two and a half times the width of the street, or say 250 feet in the vertical, in other districts twice or 200 feet, and so on. Above these heights the building had to set back within a slope of one in five. This law, owing to the rectangular shape of the building sites, has brought into existence a series of great buildings, set in at the sides perhaps to give light and air to the depths of the structure, which rise in a solid mass, say 200 feet high, and then rise again while setting back in a series of Babylonian-like terraces to buttress a central tower. The Shelton Building by Messrs. Harmon & White and the New York Telephone Building by Messrs. Vorhees, Gmelin & Walker were the first to take full advantage of the new outline the law permitted and to find in that outline, with its buttressing masses of building against the central mass, the main significance of the structure. The walls themselves in these buildings were grooved with long vertical lines in which were the windows now reduced in relative size to a series of dots. The punctuation of the mass was no longer obtained by an *appliqué* of either Classical or Gothic detail, but by an accentuation of the grooves and the consequent emphasizing of the piers between them, giving at the top of the building a serrated appearance against the sky. Here, at last, the American tall building had freed itself from all traditional methods of design, Classical or Gothic, and had found its expression in the conditions of the problem, in the steel construction, in the lighting of the interior and, most of all, in the lighting and ventilating of the surrounding streets, for that is what the Zoning Law was designed to secure. That this expression is highly satisfactory most people will agree, as they will agree that America has thereby contributed a new and very interesting type to the world's buildings. She is not standing still with this achievement to her credit, but is further developing the type in various ways. By the greater use of glass on the exterior, as well as by more electric light in the depths of the building, she is reducing the amount of setting in in the lower parts for light and air and therefore becoming possessed of a greater freedom of modelling. It is significant, owing to the plasticity of steel construction which can within reason be made sufficiently strong whatever the plan, that the architect nowadays generally begins his design with a clay or wax model, shaping his masses and planes to suit his sense of abstract proportion. In these high buildings his art more closely resembles that of the sculptor than ever before. As they grow (for economy in elevators, escalators and other central services), until each occupies a whole city block 400 feet by 200 feet, their isolation from one another becomes more and more complete. When this happens, they are separate monuments, freed from their neighbours by the surrounding streets. As experiments are continually being made, one building being in steel and glass only, warmed and ventilated through two thicknesses of the latter, another sheathed in bright metal, another in black brick, another in white, all mutual inflection disappears. It will be seen therefore that the tendency of such buildings is first to abolish the street as a street of continuous buildings, much less one of continuous design, and then to turn the town itself into a series of isolated tall structures. Unfortunately, in towns where the streets are already laid out to ordinary widths, these immense buildings very quickly overload with traffic the space between them, especially when they disgorge the people who work in them. Already a single such building may send out 25,000 persons within a few minutes. It is possible therefore that New York may have to consider in the near future a new traffic Zoning Law controlling the floor space within the buildings as the present Zoning Law controls their vertical height and outline. In the meantime the idea of a city of sky-scrapers, well isolated from one another, has become common property. Le Corbusier, the French exponent of modernism, in his book *Urbanisme*, has put forward a plan for rebuilding the business portion of all old cities in this way, while an English architect has been called in to advise the Russian Government on a new sky-scraper capital in Asia entirely so planned. The Renaissance ideal of the organic city planned and designed as a complete whole, with every part inflected and related like the apartments of a palace, must disappear with these isolated towers as the only structures and with the streets fast traffic roadways crossing one another always at right angles, bridges being the means of communication. It might perhaps be possible to give some sort of form to such a city by grouping the towers and suitably inflecting them, but unless, as suggested by Le Corbusier, the towers are combined with lower and more temporary buildings for residential purposes, as is the case in America where tower buildings are still confined to certain quarters, such a town would have little means of growth and adaptation to new needs. This presupposes also that the parade life of the Renaissance when one strolled from building to building and contemplated the architecture has already given way to one of mechanism and rapid transport.

Contemporary with the growth of a classical school in America, which received its first general recognition in the Chicago World's Fair of 1893, and thirty years before the sky-scraper finally rationalized itself into a free expression of its construction, a school of architects had grown up in Chicago to whom all traditional architecture, and particularly that based on Roman and Italian Renaissance methods, was anathema. This school, of which the late Louis Sullivan may be said to be the founder and Frank Lloyd Wright the chief apostle and prophet, claims (as indeed most architects would to-day) that their buildings are in the first and last place functional and that with them form follows function both within and without. Unlike the German and Dutch modernists, however, who have followed them in point of time as well as in the general tenor of their design, this Chicago school did not deny itself, especially in the case of its founder, the use of modelled and carved ornament. In Louis Sullivan's buildings there is a great deal of ornament which to-day seems in no way connected with the function of the building or of its parts. This is floral and naturalistic in character and designed apparently more with the notion of being different from traditional forms than for any more serious reason. It is obviously part of a revolt and as such has but temporary value. With the forms of his buildings and those of Frank Lloyd Wright it is another matter. These are a conscientious attempt to allow practical considerations to govern the architectural expression, though in the work of both men, as in that of all artists, a personal note is bound to appear. It was at the same Chicago Exhibition of 1893, in his Transportation Building, that Louis Sullivan first presented his ideas on a large scale. To-day his building with its big arched openings, its heavy cornice and flat surface decoration in plaster, would not seem so novel, but among the colonnaded Roman buildings of the Fair it stood out as a very decided protest. His flat surface decoration was certainly suited to plaster, but there is nothing in the architectural forms he used to suggest the temporary building of steel and plaster which in fact it was. Indeed the deeply recessed arches suggest just the reverse. In Frank Lloyd Wright's buildings, however, which have had their repercussion in Germany, we do see the influence of rationalization both in his plan forms and in his treatment of the new material, ferro-concrete. This material, with the external appearance and crushing strength of concrete and the tensile strength of steel, permits the use of long lintels and overhanging cantilevers which would be impossible to stone, brick or wood. Eyes trained to the proportions of construction in these latter materials naturally find difficulty in appreciating the new conditions. Buildings of ferro-concrete can take on a light spidery form impossible to those of the older materials, owing both to the tensile strength of the embedded steel and to the fact that the building when finished is a monolithic whole, standing on the ground like a piece of furniture rather than as an accumulation of small independent solids. These characteristics of ferro-concrete may not have as completely determined Frank Lloyd Wright's building forms as they have more recently determined those of certain German buildings like the great concert hall at Breslau which is constructed entirely of it, but they appear to have had great effect on them. While the tendency of ordinary steel-framed construction in New York was to aid buildings skywards, the tendency of ferro-concrete construction in the buildings of this Chicago school of architects was to give them a very powerful horizontal expression by means of long overhanging balconies and roofs projecting outwards, without apparent support from walls or piers, in a manner which would be impossible in any other material save wood. Mr. Wright's buildings have been largely domestic, and this extreme horizontal expression has suited well the expanses of the landscape in which they have been set, though when they appear in his fine Imperial Hotel in Tokio they seem almost to take on a traditional form, so like are they to the native forms of Japanese architecture. With the enormous spread of modernist building on the continent of Europe, claiming to be functional at all costs in its design and mostly showing the same horizontal emphasis, it is well to note that none of this continental work appears to have been executed before the beginning of this century, whereas both Louis Sullivan and Frank Lloyd Wright had put up many of their distinctive buildings in the nineties of last century, and that a large folio volume of the latter's work was published in Berlin in 1912.

THE MODERN MOVEMENT IN EUROPE

With an architecture which claims that perfect efficiency in a building means perfect beauty, it is clear that national expression in architecture will tend very quickly to disappear. Given equal conditions of climate and of skill in its use a machine should function equally well in any country. Certain it is that a modern concrete and glass factory looks very much the same whether it is erected in England, Germany or Russia. That a modernist house does not do so to the same extent is due to the fact that we have not yet all accepted for domestic life the theory of pure efficiency. The extreme modernist architect would make all houses interchangeable, giving to none of the same calibre any difference of design except where special requirements existed, such as that for a doctor with an additional room for a surgery. One of them, a German, says, " The æsthetics of modern architecture recognize no demarcations between façade and ground plan, road and courtyard, or between the back and front of a building. Nor does any detail exist for its own purpose alone, but should be designed to serve as a necessary part of the general plan. Everything that functions well looks well. We simply do not believe that anything can look unsightly and yet function well." It will be seen that the new movement already demands a certain amount of faith from its adherents.

Looking at this modernist work as a whole in any illustrated volume of it, it appears that the most powerful and satisfactory structures are those for some isolated factory, where the various units of the group can be seen both as individual structures and in relation to the group. Thus the sloping lines of cooling towers against the solid vertical mass of the engine house, and that again seen against the multiple floors of the factory proper, with its mesh of similar windows and the whole bound together by its roads and rails for the ingress and egress of materials and products, often, especially when in the hands of an artist like Erich Mendelsohn, provide a composition with great significance in its forms. For the equipment of a modern factory tanks of striking shape, raised high in the air, are often required. The architect of a generation ago would have tried to enclose all these things within screen walls and under roofs hiding their shapes. The architect of to-day seizes on them with avidity as significant forms and makes them play a definite part in his composition. Erich Mendelsohn makes models of all such work, so that he can better judge the relative value of his planes and masses. Anyone who has seen either his models or photographs of them will at once admit that by mass composition of this kind he has introduced into such work, or rather released from it, an element of combined beauty and power which is a new thing. The same may be said of the great masses of tenement dwellings erected outside most German and Dutch towns since the War. By the relations of the mass of one block against another, by the strength of the solid-fronted balconies and the deep shadows under them, such groups of building, without any decorative features and with all parts designed in a purely functional manner, have been made very impressive. To an Englishman or an American they may have nevertheless not a little of the effect of a giant prison where the individual is reduced to an inconspicuous unit. The vast Viennese post-War blocks of flats are much more human in this respect. Though they rely for their main effect on mass planning and the relation of one block to another, their relationships are not so hard and rectangular. Unlike most of the German ones these tenement houses, which have caused so much interest of recent years, are built on irregular town sites. That alone has prevented the rigidity and mechanical appearance of the German and Dutch schemes built generally on free sites, but there is a temperamental difference as well. The old tradition of elegance still clings to these Viennese workmen's dwellings, and curved plan forms, which are certainly not dictated by function, are still allowed to creep in. Perhaps the most pleasing of all the modernist buildings on the Continent are the new theatres and cinemas, where curved forms are largely used in the interiors and here assumed, I suppose, to be functional, though it may be doubted whether they are the best for sound. Combined with new methods of indirect or hidden lighting these interiors, relying purely on their interesting shapes for effect and with no decoration other than surface colouring, are extraordinarily effective and contrast very strongly with the over-decorated and modelled theatres of England and America. The same may be said, if to a less degree, of the great exhibition halls. Indeed, in tracing the growth of modern functional architecture most writers begin with the large glass and cast iron buildings of the first great international exhibition, that of London in 1851. The buildings of this still exist to-day under the name of the Crystal Palace at Sydenham in South London, where they were re-erected after the exhibition, and certainly they express in a very dignified way their function of providing a series of great well-lit halls, each large enough for the exhibition of the largest industrial objects such as steam engines, and with galleries for smaller objects. It may be doubted whether any purely functional exhibition buildings have ever been more successful; the exhibition buildings of Paris, Chicago, St. Louis, Panama and the like, until we come to the quite modern exhibitions of Gothenburg, Stockholm and Antwerp, being designed to make a romantic appeal to the imagination by the association of ideas that their traditional forms call forth. The machinery halls at the Paris Exhibition of 1887 and 1889 had something of the quality of the Crystal Palace, but with less grandeur in their lines. The great hall for the cattle market at Lyons by Tony Garnier was the first of the great glass and iron roofs, which were developed during the last half of the nineteenth century for a variety of purposes, to introduce purely vertical glazing in a series of stages. This roof however has a simple triangular section, but the idea contained in it of a series of small stepped roofs above the principals has been developed and used in the extraordinarily elegant modern halls where the principals are arches of parabolic section, either built up in solid timber, as in the concert hall of the Gothenburg Exhibition, or in ferro-concrete, as in that of the Horticultural Hall in London. These halls are among the few instances, except for theatres and cinemas, where the modernists have allowed themselves the pleasure of curved shapes. This avoidance of curves is perhaps natural when one remembers they are usually dealing with beams of wood or steel, and that the obvious functional form of these is a straight line; the pleasure that the classical architects derived from clothing such rectangular forms with curved plaster semidomes and domes being of course denied to them by their principles.

In France the modernist movement, as in England, is at present confined to the work of a few men and cannot yet rank, except perhaps in furniture and decoration, as a school of thought in the way it does in the Teutonic countries. Probably the Eiffel Tower, with its frank but thoroughly graceful exposure of its construction, did more than any other single erection to reawaken in France an interest in structural form as such, and to break down to a limited extent the classical camouflage of construction which the teaching of the Ecole des Beaux Arts implied. Messrs. A. & G. Perret with their ferro-concrete churches in Paris, particularly with that at Le Raincy, have been foremost in exploiting this material for buildings in the light airy forms of which it is capable, though French engineers have a vast number of extraordinarily graceful bridges, in the new forms dictated by it, to their credit. The tendency of French designers in this material, as shown in the work of the brothers

Perret, is to emphasize the quality of lightness combined with strength of which it is capable, while in Germany one finds massive and monumental effects still aimed at, such as that of the interior of the great market at Frankfort, which should belong functionally to the expression of mass concrete rather than that of ferro-concrete. The houses of Le Corbusier, Malet Stevens and André Lurcat in Paris and Versailles, while consisting of compositions of rectangular forms as in the similar modern German ones, have an added appearance of lightness and grace owing to the thinness of their walls, roofs and balconies which is made possible by these qualities of reinforced concrete. For the highest expression of such qualities, not as yet generally connected in the public mind with modern functional design in modern materials, the reader is referred to M. Malet Stevens's delightful Casino at St. Jean de Luz in the south of France.

It is impossible to leave the question of modernist expression in architecture without mention of the position in Sweden, for since the building of the new Town Hall at Stockholm by Rägnar Östberg that country has become an architectural Mecca. It must be stated at once, however, that though there is a strong modernist movement in Sweden, connected chiefly with the name of Gunnar Asplund, neither the Stockholm Town Hall nor the other new buildings which have recently attracted architects to Sweden, such as Ivar Tengbom's Högalid Church, his Concert Hall and delightful offices for the Swedish Match Corporation, all in Stockholm, nor Carl Westman's Law Courts, Stockholm, nor his Arts and Crafts Museum, Gothenburg, nor Arvid Bjerke's Schools, Art Gallery and Concert Hall at Gothenburg are modernist functional buildings in any particular sense. On the other hand they are not to be classed either as Classical, Gothic or Eclectic buildings, but rather as free interpretations of the Classical or Gothic motives controlled by the excellent taste and personalities of the designers. Östberg's great Town Hall, in many ways the most remarkable of all modern buildings, though imbued with the mediæval spirit in the main lines of its composition, is a highly individual piece of work, in which a great architect has been able to use without disharmony motives derived from Byzantine, Mediæval and Renaissance sources and yet combine them into a unity—harmony would be the better word—by the strength of his own genius. In the same way he has absorbed into his building much diverse craftsmanship in painting, sculpture, metal work and mosaic, without clash of interest or sacrifice of his own romantic feeling. He has indeed proved himself here the master builder very much as a mediæval master builder did with church or cathedral. Ivar Tengbom shows the same capacity, but strives for and obtains a greater sense of unity, either when working on mediæval motives, as in his great church, or on Renaissance ones as in his banks and office buildings. Every detail of his buildings down to the smallest piece of door furniture, wherever the motives come from, shows a marked personal touch. In this his architecture resembles that of Sir Edwin Lutyens. One feels, however, with regard to all this fine new Swedish work that it may be the happy accident of a group of brilliant men—architects, sculptors, metal workers and decorators, but chiefly the first—existing at one fortunate moment, when their country could place the means at their disposal, working over the old ground and refining upon the jewels already discovered, and that when they pass away the capacity for it may pass with them. Regretfully one does not find in it, especially in its most distinguished characteristics and indeed in the very things for which one loves it best, any consistent school of thought or philosophy of design such as one finds in the work of the modernists, whether in Europe or America. This latter, so it seems, however crude at present, holds within it the seeds of, and the potentiality for, endless development.

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AN INTRODUCTION TO MUSIC

By

R. O. MORRIS

SYNOPSIS

art I. The Main Current. Explanation of the standpoint from which the
rticle is written (§ 1). It starts with a glossary of the commonest tech-
ical terms necessary to follow the argument (§ 2). *Harmony.* Elements
f harmonic procedure; a few very simple fundamentals form the basis
f harmonic structure; the apparent complexity of music is due to
xtensive employment of the unessential. Dissonance and the method
f its resolution; meaning of Modulation (§ 3). *Texture.* Difference
etween the harmonic and contrapuntal types. Harmonic figuration
ı essential feature of orchestral technique (§ 4). *Design.* First prin-
ples illustrated by folk-song; binary and ternary types (§ 5). *Design*
continued). The early Suites and Sonatas; description of the various
ıovements of which these normally consist (§ 6). *Design* (continued).
he symphonic form. Ambiguity of the terms in common use;
escription of the usual movements comprised in a Sonata or
ymphony; analysis of the structure of these various movements
7). *Design* (continued). The contrapuntal forms; descriptive analysis
Fugue and Chorale prelude (§ 8). *Design* (continued). Variation
orm and the Concerto. A word of caution; form is more than dry
ones, but one cannot really understand the living form without some
ıowledge of the bony structure (§ 9).

art II. Modern Problems. Harmonic novelty not the only con-
deration. Increasing freedom and complexity of design; formality
ıt of fashion (§ 1). *Harmony.* Increasing use of dissonance; a new
efinition of discord required if modern procedure is to be adequately
plained. Modern harmony chemical rather than mathematical (§ 2).
lytonality. Explanation of the term: reasons for mistrusting it as a
ethod of procedure (§ 3). *Atonality.* Current meaning of the term;
arbitrary and anarchical nature. No use trying to scrap the tradi-
onal language of music; it may be enlarged but not superseded (§ 4).

art III. Earlier Developments. 850–1300 the Palæolithic period of music ; interesting to the antiquarian but not to the ordinary music-lover. 1300–1600 a period of continuous development, culminating in the great age of Palestrina and the Elizabethan composers (§ 1). *Scale*. The Modal System. Description of the Modes and their gradual modification into our modern scales (§ 2). *Harmony*. This music rests on a basis of pure consonance ; all discord has to be strictly prepared and resolved (§ 3). *Rhythm*. Time-signatures employed ; the same in effect as our own, though different in name. Freedom and intricacy of rhythmical structure superimposed on this metrical basis. Conclusion (§ 4).

AN INTRODUCTION TO MUSIC

PART I

THE MAIN CURRENT

I

Never before, probably, has music had so wide an audience as it has to-day. Orchestral music, in particular, is being introduced by means of the gramophone and the radio to thousands and hundreds of thousands of people who have never been to a symphony concert in their lives. A very large number of these discover, perhaps to their own surprise, that the new experience is a source of enjoyment; and as that enjoyment grows, there is added to it a certain curiosity, a desire to know as well as to enjoy; to understand, if possible, something of the methods and principles underlying this mysterious art of music.

It is for them, and them only, that this Article is written. It is not intended for the professional musician, or even the experienced amateur. Its only assumption is that the reader is sufficiently interested in music to want to know something more about it than he knows already, and its only object is to supply this knowledge in the broadest outlines and the simplest possible terms. In so far as these terms are technical, as to some extent they must be, they are explained beforehand in the glossary which immediately follows this introductory section. Any technical terms not found in this glossary will be explained as they occur in the course of the Article.

By far the greater part of the music that is heard and played is music that was composed between 1650 and 1900. This may be considered, from the harmonic and theoretical point of view, as a single great epoch or period of musical history. It embraces many styles, many different methods of construction, many kinds of texture; but the actual idiom of music, the harmonic vocabulary, so to speak, is a constant factor. It is amplified and enriched, but not fundamentally altered; its basic principles remain unchallenged. We shall see in due course what those principles are, and how they differ from those of earlier and later periods; meantime, let it be noted that what is said in Part I. of this Article holds good *for this period only* (1600–1900). The earlier and later periods are treated, more briefly, in Part III. and Part II. respectively. Few would deny that this is the order in which they rank as regards their general interest and significance from the ordinary music-lover's point of view, and it is precisely from that point of view (to repeat what has already been said) that the subject is here presented. Hence our departure from the chronological order of exposition.

Here follows a preliminary explanation of some of the commonest technical terms in general use. It is only just so much as will serve to make the subsequent parts of the Article readily comprehensible; readers who wish to expand their knowledge of the subject should procure one of the text-books of musical rudiments by C. H. Kitson, F. J. Read, or Stewart Macpherson. All three are excellent; they confine themselves strictly to the object in view, and present an immense amount of information in a concise and readily accessible form. They are intended primarily for the budding professional, but starting as they do from the very beginning, they are equally suitable for the budding amateur. For our immediate purpose, however, the following will suffice. The terms are classified according as they apply primarily to melody, to harmony, or to rhythm; but it will be noticed that some—*e.g.* cadence, inversion—belong to more than one category, and are used in more than one sense. It is usually clear from the context, however, which particular sense of the term is implied at any given moment.

A

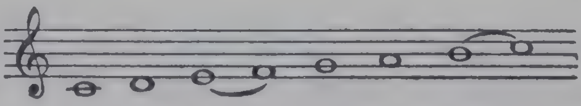
Terms used in connexion with Melody

Scale. A succession of notes proceeding stepwise, and unified by their relationship to a *tonic* or *key-note*. (In a *diatonic* scale there are usually five whole tones and two semi-tones. According to the position in which these semi-tones are found the scale is major or minor, the third note of the scale being the determinant.)

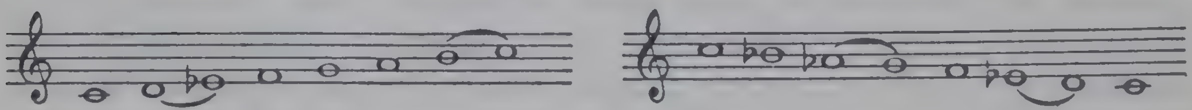
Examples of the major and " melodic " minor scales, the semitones being shown by slurs:

C major: (The same notes whether ascending or descending)

Ex. 1.



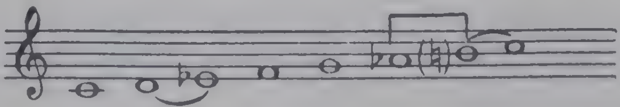
Ex. 2. C minor: (Ascending) (Descending)



In the " harmonic " minor scale there are three whole tones, three semitones, and one augmented interval (see below, under the head " Interval ").

C minor (harmonic): (the same whether ascending or descending)

Ex. 3.



As was said above, the minor third is the real determinant of the minor scale, and in practice one usually speaks in this general way of " the major " or " the minor," ignoring the further classification of " melodic " and " harmonic " minor.

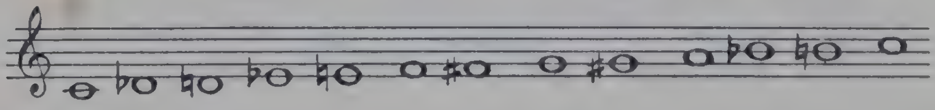
Each note of the scale has its own particular designation (the same for both major and minor forms). These, given in ascending order, are as follows :—

1st note	Tonic (or Key-note)
2nd ,,	Supertonic
3rd ,,	Mediant
4th ,,	Subdominant
5th ,,	Dominant
6th ,,	Submediant
7th ,,	Leading-note

Of these, " tonic," " dominant," " subdominant," and " leading-note " are terms in constant use, and should be kept carefully in mind. In the scales of C, shown above, they designate the notes C, G, F, and B respectively.

A *chromatic* scale is a scale proceeding entirely by semitones :—

Ex. 4.

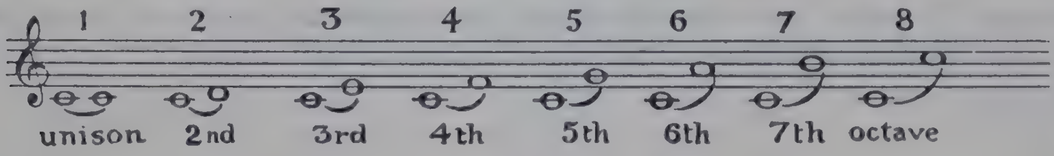


(*N.B.* A "sharp" (♯) raises the pitch of any note by a semitone: a "flat" (♭) lowers it to the same extent: a "natural" (♮) contradicts a previous flat or sharp, thus restoring the note to its original or "natural" pitch. These signs are known collectively as "*accidentals*.")

Interval. The distance (or difference of pitch) between any two notes sounded in succession.

Intervals are named primarily according to the number of degrees of the scale included in their formation, *e.g.*

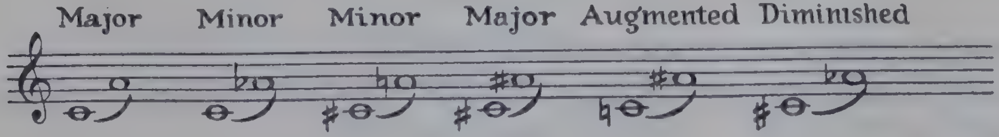
Ex. 5.



These names are constant, as far as they go, regardless of chromatic alteration, or (to put it more obviously though less accurately) of sharps and flats.

For example :—

Ex. 6.



These intervals are all different, but all are expressed in terms of C and A; therefore all are sixths of one sort or another. The further modifications—major, minor, augmented, diminished—are determined by the total number of semitones contained in the interval. It is not here necessary to enter into further details of this technical point.

A *diatonic* interval is one that occurs in any of the diatonic scales.

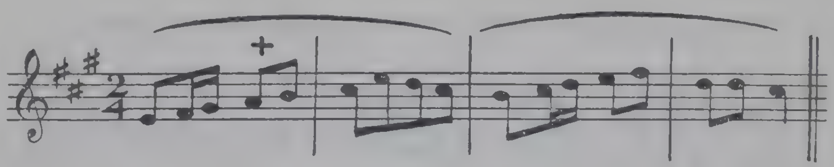
A *chromatic* interval is one that only occurs in the chromatic scale.

Of those shown in the last example, the first four are diatonic, the last two chromatic.

An *enharmonic* interval is one of less than a semitone—*e.g.* G♯–A♭. Another common definition of it is " change of name without change of sound." This is accurate so far as the piano is concerned; but on other instruments—notably the stringed instruments—G♯ and A♭ are by no means identical.

Key. The *key* in which a melody is said to be written is determined by the scale from which the notes forming the melody are derived. It is not necessary that the melody should either start or finish on the tonic; for example :—

Ex. 7.

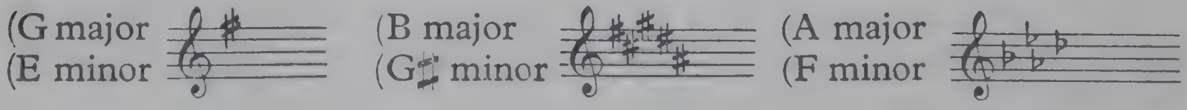


Here the tonic (A) occurs only once, and by no means in a prominent place, yet the ear has no doubt whatever that it *is* the tonic. That is because the notes found in the melody all occur in the scale of A major, but not all in any other scale.

There are thus as many possible keys as there are major and minor scales. To find the order of the " sharp " keys, work *upwards* in perfect fifths starting from C :—C, G, D, A, E, B, F♯, C♯. To find the order of "flat" keys, work similarly *downwards* :—C, F, B♭, E♭, A♭, D♭, G♭, C♭.

The number of sharps or flats required by any given key is shown by writing them at the beginning of the staff. Each of the " sharp " keys in the order shown above requires one more sharp than its predecessor, each of the " flat " keys one more flat. This indication is known as the *key-signature*. A minor key has the same key-signature as its relative major key—*i.e.* the key whose tonic is a minor third above its own. For example :—

Ex. 8.



B

Terms used in connexion with Rhythm

Music is measured by *bars*, which in turn are sub-divided into *beats*. Most commonly there are 2, 3, or 4 beats to each bar, and the music is then said to be in *duple*, *triple*, or *quadruple time*.

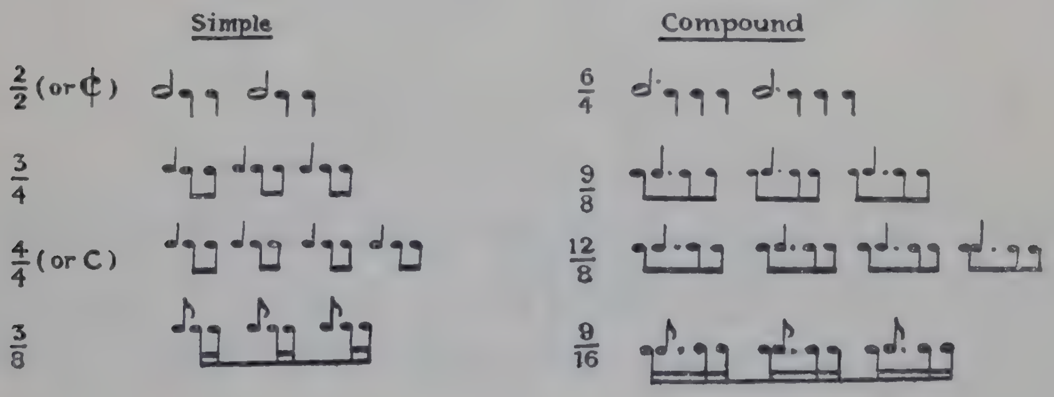
These beats again may sub-divide into groups of shorter notes, primarily into groups of 2 or 3. If the division is into groups of 2, the time is called *simple*; if into groups of 3, *compound*.

These details are indicated by the *time-signature*, which is placed at the beginning of the piece, immediately to the right of the *key-signature* (v.s.); it takes the form of two numbers, one above the other. The upper of these shows how many notes of a particular kind there are in a bar, the lower tells what particular kind of notes they are (or, to speak more precisely, what fraction of a semibreve each note represents).

Such points are made much clearer by illustration than by definition. Let us take two common time-signatures $\frac{2}{4}$ and $\frac{9}{8}$. In the first of these, the lower figure (4) shows that we are dealing with *quarters of a semibreve*, *i.e.* with *crotchets*; the upper (2) that there are two of these in each bar. In the other case, the lower figure (8) indicates *quavers* (*i.e.* eighth-parts of a semibreve), the upper (9) that there are 9 of these in each bar.

The upper figure further indicates whether the time is simple or compound (v.s.). If it is 2, or 3, or a multiple of 2, it is simple. If it is a multiple of 3, it is compound.

A glance at the following table, which is representative though by no means complete, should make all this quite clear :—



(A dot placed after a note lengthens its value by one half, indicating that it is worth 3 (not 2) of the note next below it in value. Therefore in compound time the beats are always dotted notes; in simple time, plain notes.)

Just as the *beats* in music are grouped in *bars*, so the bars themselves may be grouped in larger and still larger units known (by analogy) as phrases, sentences, periods and so forth. For the time being, this analogy may be considered as applying to all music that is definitely formal in construction[1]; and the following definitions may be provisionally accepted, though the terms are elastic :—

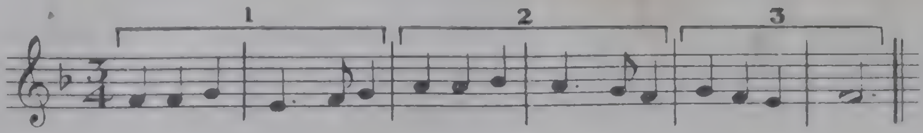
A *phrase* is the smallest unit of rhythmical structure; it commonly, though not necessarily, consists of two bars, and is felt to be essentially incomplete. It is therefore followed by one (or more) similar phrases which combine with it to form a *sentence*.

---

[1] In particular, to the song- and dance-forms in which so much of the music of the seventeenth and eighteenth centuries is cast.

For example, the first sentence of " God Save the King " consists of three 2-bar phrases :—

Ex. 9.



Similarly, a *period* consists properly of two or more sentences similarly balanced ; but such terms as " period," " sentence," " strain," are often used very loosely and in practice are almost interchangeable, each of them denoting a unit of musical thought which is *complete as far as it goes*, as distinguished from the phrase, which is essentially incomplete.

All these smaller units of musical thought are defined by *cadences*. Cadence is to music, roughly speaking, what punctuation is to literature. The word means literally " fall," and in the earliest days of European music the plainsong melodies always did end in this way—by a fall of one degree to the tonic. In more modern times the term has a wider and less clearly defined sense. Harmony plays such an important part in cadence formation that it will be more convenient to consider it in connexion with harmony rather than with rhythm pure and simple.

C

Terms used in connexion with Harmony

Interval. Two notes sounded simultaneously. If less than an octave, the interval is simple ; if more, compound.

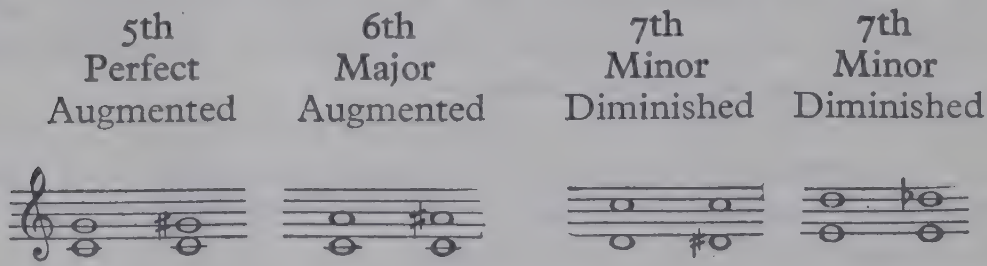
Intervals are classified according to their *consonance*—*i.e.* according to the degree in which the two sounds blend or fuse together. The usual classification is as follows :—

Perfect consonances. Unison ; octave ; perfect fourth ; perfect fifth.
Imperfect consonances. Major and minor thirds ; major and minor sixths.
Dissonances. Major and minor seconds ; major and minor sevenths ; all augmented and diminished intervals.

An augmented interval is formed by sharpening the upper note or flattening the lower note of a major or perfect interval.

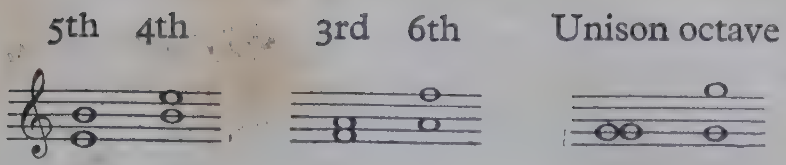
A diminished interval is formed by flattening the upper note or sharpening the lower note of a minor or perfect interval ; *e.g.* :—

Ex. 10.



An interval is said to be inverted when the lower note is placed an octave higher, or the higher note an octave lower :—

Ex. 11.



N.B.—The 4th inverted becomes the 5th and vice versa.
„ 3rd „ „ 6th „ „
„ 2nd „ „ 7th „ „
„ unison „ „ octave „ „

Furthermore :

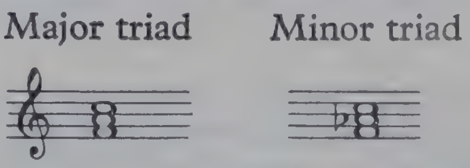
Perfect intervals when inverted remain *perfect.*
Major intervals when inverted become *minor* and vice versa.
Augmented intervals when inverted become *diminished* and vice versa.

Chord. A chord consists of two or more intervals sounded simultaneously.

(If these intervals are all consonant, whether perfect or imperfect, the chord is a *concord.* If one or more of them is dissonant, the chord is a discord.)

A *triad* (or *common chord*) consists of a bass note (or *root*) together with the major or minor 3rd and the perfect 5th above it : *e.g.* :—

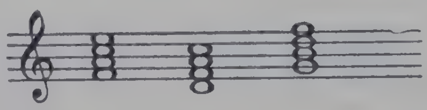
Ex. 12.



(If the fifth is augmented or diminished, the triad is known as an " augmented " or " diminished " triad, and is no longer called a " common chord." It is, moreover, a discord, owing to the presence of the augmented or diminished interval.)

The *chord of the 7th* is formed from a triad by adding the 7th note above the bass :—

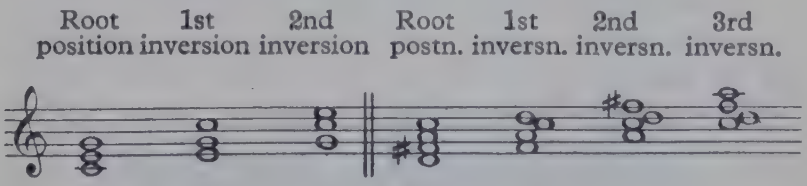
Ex. 13.



Such chords can be formed on every degree of the major and minor scale ; for our present purpose that formed on the *dominant* of the scale (the " dominant 7th ") is by far the most important.

Chords, like intervals, are said to be *inverted* when the root is transposed into a higher octave :—

Ex. 14.



In each of these inversions the *root* of the chord (C in the first three, D in the other four) is always the same, although the bass note is changed successively with each inversion.

Cadence, as has already been said, is akin to punctuation. Cadences are of two main families :—

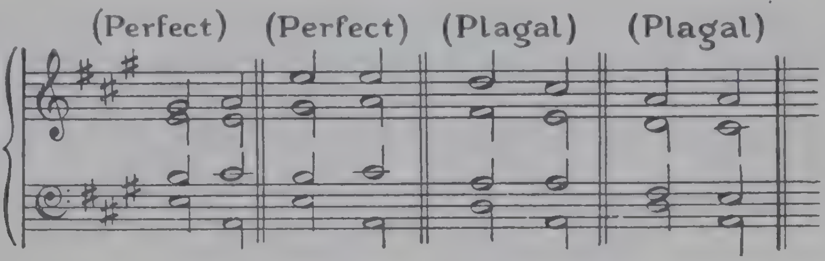
(1) *Final* cadences, such as usually mark the close of a period or section.
(2) *Intermediate* cadences, such as define the limits of a phrase or short sentence.

Final cadences are of two kinds :—

(1) The *Perfect* cadence (or " Full Close ") in which the dominant chord with or without the 7th is followed by the tonic chord in root position.
(2) The *Plagal* cadence, in which the subdominant chord (instead of the dominant) precedes the final tonic.

For example :— (Key A major)

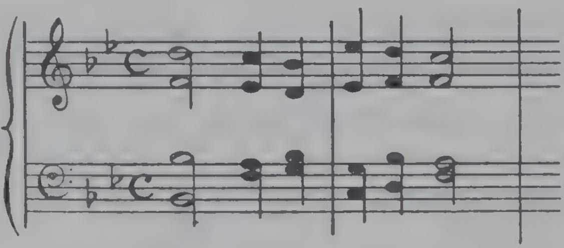
Ex. 15.



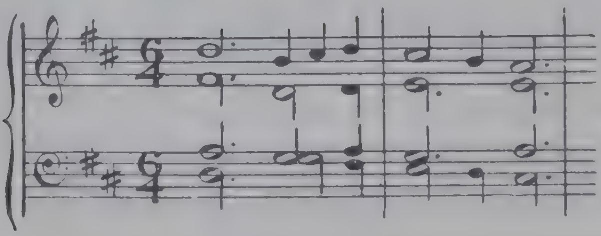
It will be noticed that although the root stays unchanged in the bass, the spacing and disposition of the upper parts is varied in each pair of cadences. The upper notes are the same, but their positions are interchanged. This does not modify the essential character of the chord in any way ; this point will receive further explanation in the next section.

Intermediate cadences are usually formed on the dominant chord, which may be preceded by the tonic or by some other chord, neither being necessarily in root position. Here are three short phrases in three different keys, each ending with a different kind of intermediate cadence (or " Half Close ") :—

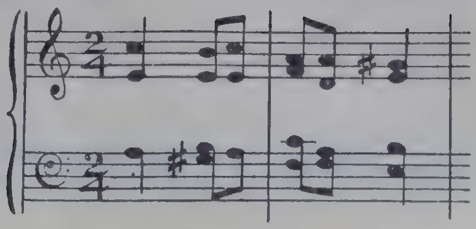
Ex. 16. (1) B♭ major



(2) D major



(3) A minor



So far the terms requiring explanation could not well be set out in concise tabular definition as in a dictionary. But we may now add to them a few more, of common occurrence, which may be thus briefly defined :—

Conjunct movement. Movement of notes by step, *i.e.* with not more than the interval of a tone between any two successive notes.

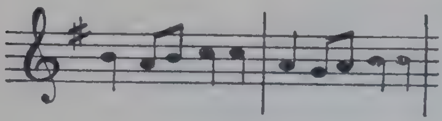
Disjunct movement. Movement of notes by leap (of a third or some larger interval).

(For example, " God Save the King " proceeds wholly by conjunct movement, except for the leap of a minor third between the 3rd and 4th notes.)

Sequence. The repetition of a fragment of melody or harmony at a different pitch. For example :—

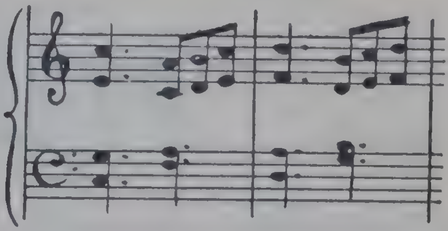
(Melodic)

Ex. 17.



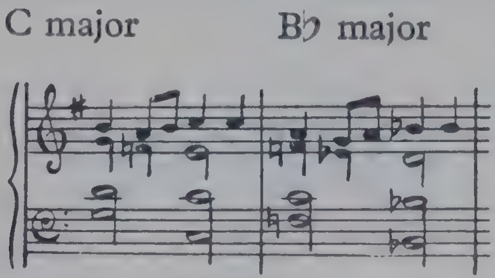
(Harmonic)

Ex. 18.



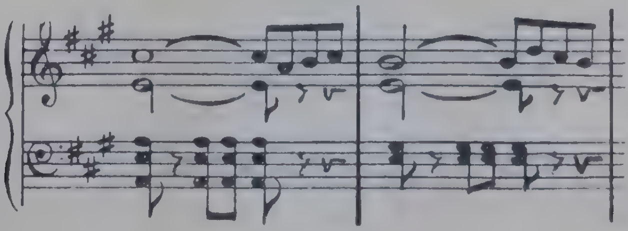
The above sequences are both *diatonic*. A *modulating* or *chromatic* sequence repeats the progression in a new key :—

Ex. 19.



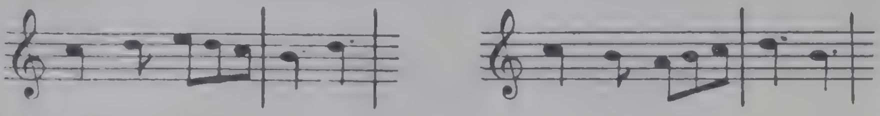
Pattern. Akin to sequence, but less exact ; denotes the prevalence of some single rhythmic figure in the melody, or the harmony, or both :—

Ex. 20.



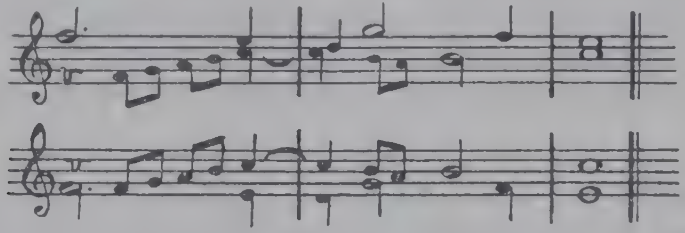
Inversion (melodic). A phrase is said to be inverted melodically when the *intervals* between its successive notes are of the same nature, but taken in the opposite direction :—

Ex 21.



Inversion (contrapuntal). The interchange of two parts so that the higher becomes the lower and vice versa. (Counterpoint itself is explained in the following section.) For example :—

Ex. 22.

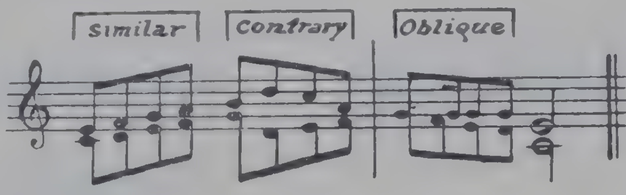


Similar movement. Movement of two parts in the same direction.

Contrary movement. Movement of two parts in opposite directions.

Oblique movement. Movement of one part while the other stands still or repeats the same note, *e.g.* :—

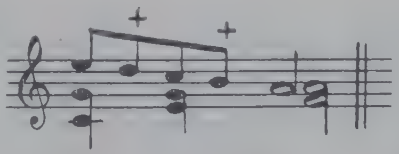
Ex. 23.



Essential note. A note that is an essential part of any given chord—*e.g.* the note E in the triad C E G.

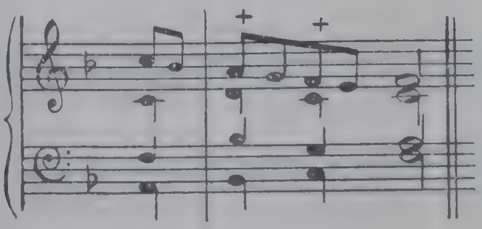
Passing (or unessential) note. A note that merely serves to connect two essential notes of two successive chords (or intervals), and is not itself part of either chord (or interval), *e.g.* :—

Ex. 24.



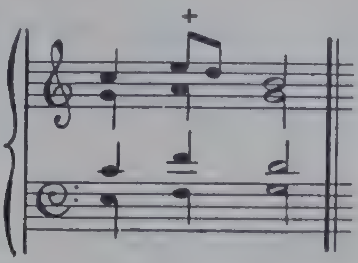
In the above, the passing notes (D and B) come *between* the beats and are therefore called *unaccented* passing notes. They may also occur *on* the beat ; they are then known as *accented* passing notes :—

Ex. 25.



Such a note may also be approached by leap ; it is then called an *appoggiatura,* or " leaning note," because it leans, so to speak, on the essential note to which it is prefixed :—

Ex. 26.



(*N.B.* " Appoggiatura " is often used loosely to denote any strongly accented unessential dissonance.)

Modulation. Passing from one key to another.

Transposition. The reproduction of a given piece or passage bodily in a new key.

Resolution (of discord). Its passage into consonance—normally by the stepwise movement of the dissonant note—as in Ex. 25, where the notes A and F (marked with a cross) " resolve " into G and E respectively.

3

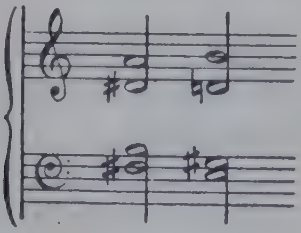
Harmony

The object of this section is not to enter into technical details or rules of procedure. It aims rather at a correlation of harmony with other aspects of music, such as texture and design, and will only consider such harmonic problems as bear directly upon those wider relationships.

Let it be stated first of all that the actual material of harmony is limited in extent and simple in character ; it consists indeed of the handful of common chords and diatonic sevenths which have already been enumerated, and of very little else. The enrichment of musical speech during this period is due mainly to an ever-increasing use of the unessential—passing notes, appoggiaturas, and so forth. New-seeming chords will be found on examination to be merely chromatic alterations of the old ones ; apparent novelties of idiom reveal themselves merely as unexpected juxtapositions of what is *per se* familiar. Two simple illustrations will serve to make this clear.

Take first of all this pair of chords :—

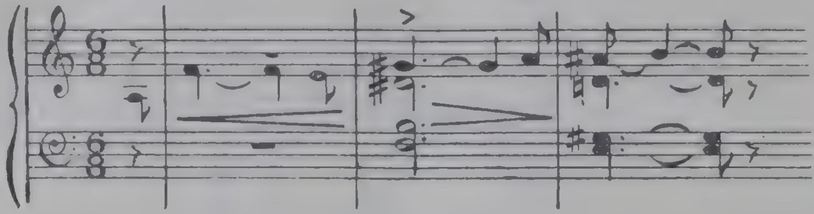
Ex. 27.



The dominant seventh of E, followed by the dominant seventh of A ;

what could be simpler, or (seemingly) less apt for the expression of intense emotional strain ? Yet look now at the opening of *Tristan and Isolde* :

Ex. 28.

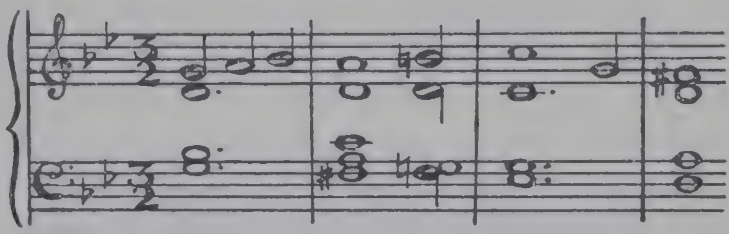


It is beyond question one of the great utterances of the world, yet the harmonic element is derived entirely from these two simple chords. True, the upper note of each is delayed by an appoggiatura (G♯ in the second bar, A♯ in the third) and the first has its bass note (F♯) lowered chromatically to F♮. But whoever would have thought that so surprising a transformation could have been wrought by so time-worn a device ?

Above all, one must not overlook the significance of the rests : the harmonic silence of the first bar is as eloquent as the harmonic speech of the second and third.

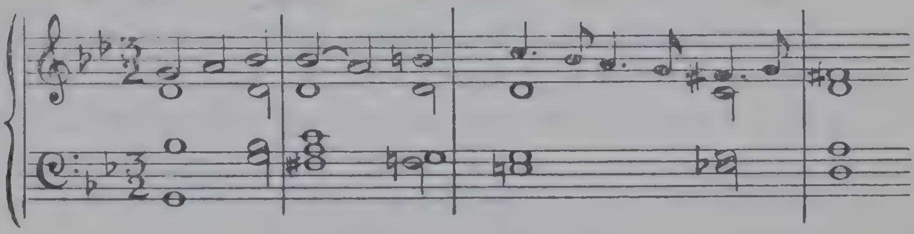
Turn now to our second illustration, and first of all consider the following passage :—

Ex. 29.



Tonic and dominant of G minor ; tonic and dominant of C minor ; dominant once more of G minor. Yet see what Purcell makes of these guileless progressions in the famous lament from *Dido and Æneas* :—

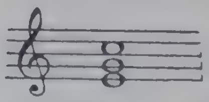
Ex. 30.



Once more a miracle has been achieved by means of the appoggiatura (B♭ at the opening of the second bar and F♯ towards the end of the third bar in the top part ; D in the third bar in the alto part), aided by one simple chromatic—the E♮ taken by the bass in the third bar, *en route* from F to E♭.

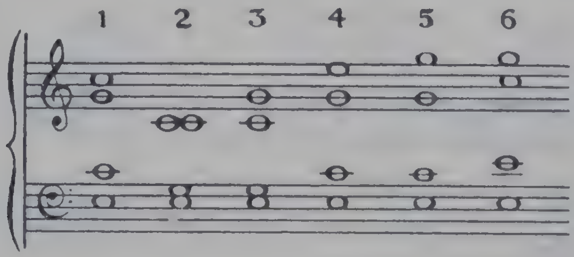
One thing that may at first sight perplex the reader is that these fundamental chords of music, the triads and the sevenths, should consist of so few essential notes—3 and 4 respectively. He knows that a modern orchestra contains anything from 50 to 100 or more players, most of whom are kept fairly busy most of the time, and even allowing for a liberal use of unessential notes, it must seem strange that so large a force should be employed to play chords of only 3 or 4 essential notes.

This question will be partially answered in the section dealing with musical texture; but the question is not wholly one of texture. It is also one of spacing, and to that extent can and should be answered here. If the reader will turn back to Ex. 14, he will see that every chord has a root position, in which the root of the chord is in the bass, and also various inversions, in which each of the other notes in turn is put in the bass. In each of these positions the upper notes of the chord may be arranged in any order; moreover any note or notes of the chord may be doubled within reason[1] at the unison or octave, so that any instrument, however high or low its pitch, can always be assigned a note that lies within its effective compass. Take first of all the first inversion of the common chord of C major :—



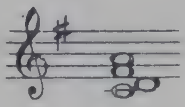
Here are some simple spacings of this chord in four parts only, such as would be suitable to be sung by four voices (the usual S., A., T., B.) :—

Ex. 31.



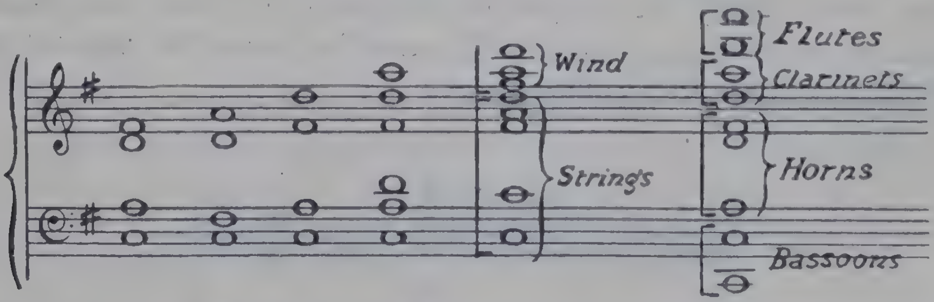
The E in the bass (which determines the chord as being the first inversion) remains constant; the upper parts quite otherwise. In 1 and 2 C is doubled, in 3 and 5 G, in 4 and 6 E.

Now take the dominant chord in the key of G, in its third inversion :—



Here again are six out of the many possible spacings : the first three are once more ordinary four-part spacings, suitable for voices; the other three show how the spacing and doubling may be extended in height and depth to suit a large body of instruments :—

Ex. 32.



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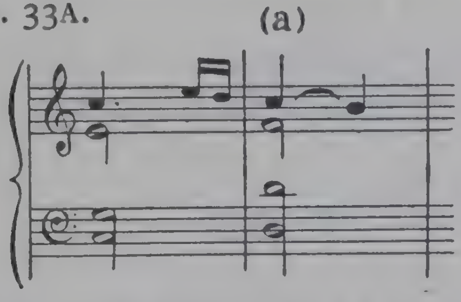
[1] One has to be rather careful about doubling dissonant notes, but it is not here necessary to detail the technical precautions commonly laid down to guide students in this matter.

In the last two the brackets have been added to show how the constituents of the chord might be grouped and assigned to some of the various orchestral families. The only principle at work here is : keep the spacing fairly even and don't mass your notes thickly in the lower regions of the chord, except for certain special effects.

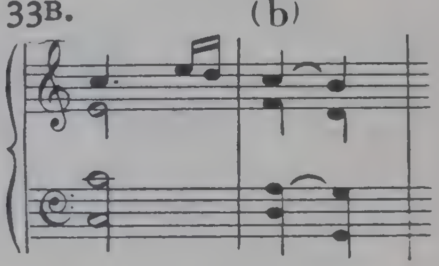
Before leaving this section a few words should be said about dissonance, or discord, and its resolution, and also a few words about modulation. First of all, dissonant notes (as has already been implied if not actually stated) are of two kinds, essential and unessential. They are " essential " when they are constituents of a fundamental chord : in any of the diatonic sevenths, for example (see Ex. 13), the seventh is a dissonant note and the chord itself is an " essential " or " fundamental " discord. They are " unessential " when they are passing notes or appoggiaturas (see above, p. 1015).

In each case, the " resolution " of the dissonant note or notes is normally by step, but there is this difference, that when the dissonance is unessential, the rest of the chord merely waits for its resolution ; when it is essential, the other voices commonly pass to a new chord whilst the resolution is taking place. Consider the two following cases :—

Ex. 33A.



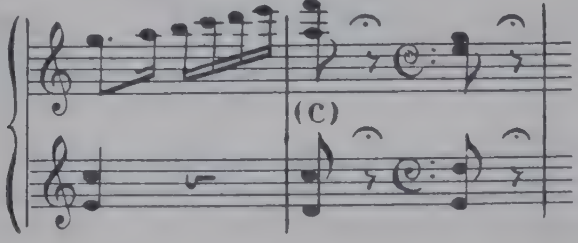
Ex. 33B.



At (*a*) the note C is felt to be merely a strongly accented passing note prefixed to B, the note for which the rest of the chord is waiting. At (*b*), although as before it resolves on B, it is an essential constituent of the fundamental discord $\begin{smallmatrix}\mathrm{C}\\ \mathrm{A}\\ \mathrm{F}\\ \mathrm{D}\end{smallmatrix}$ (the supertonic seventh in the key of C), and therefore the chord is resolved as a whole into the new consonance $\begin{smallmatrix}\mathrm{D}\\ \mathrm{B}\\ \mathrm{G}\end{smallmatrix}$ (the dominant) which is reached simultaneously by all voices. This is, technically, the difference between " resolution of dissonance " and " resolution of discord."

In the latter case, the stepwise resolution is often dispensed with, provided the discord as a whole is followed by one of its normal chords of resolution. Consider the following :—

Ex. 34.



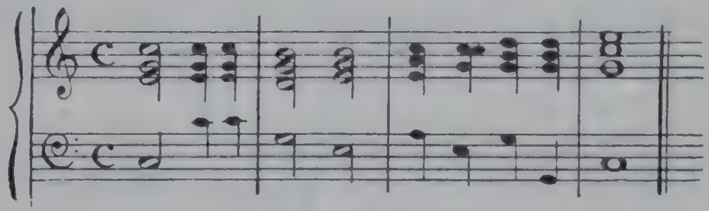
Here the C at (*c*) never gets resolved at all, strictly speaking; yet the chord-progression is just as logical and satisfactory to our ears as that above (Ex. 33B). This is due really to mental association, which has played a part of incalculable importance in the development of harmonic thought. The actual *chords* in 33B (*b*) and 34 (*c*) are the same; therefore the latter is accepted as an equivalent or paraphrase of the former, and the dissonant note—C—is *felt as resolved*, though there has been no actual resolution of it. (*c*) only became possible when (*b*) had long been familiar.

Therefore, we are entitled in spite of apparent contradictions to say that throughout this period—1650–1900—the governing principle in the treatment of dissonant notes is that they must resolve stepwise.[1] This is not literally true, as the above example shows; but it is seen to be essentially true as soon as we pass through the appearance to the reality behind it.

Now for modulation. This has already been defined as " passing from one key to another," but the question may well be asked, How do we know when a new key has been established? This question cannot be brushed aside, for when we come to examine the methods of large-scale musical construction, we shall find that one of the basic principles involved is that of *key-distribution*. Therefore we must know something more than a mere definition if we wish really to understand what the composer is driving at, for he does not trouble to change his key-signature every time he changes his key; he uses accidentals (see p. 1007).

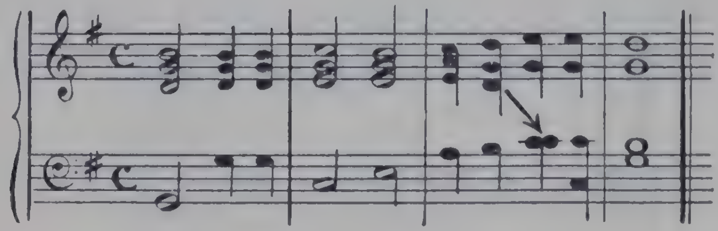
To some extent it is a matter of context. Consider this passage :—

Ex. 35.



and now this :—

Ex. 36.



Each of these consists of the same four chords—C major, G major, E minor, A minor; there is not a single note that is not common to the two keys of C major and G major. Yet there is not the slightest doubt that the first is in C, the second in G, and that the key-signature of G is correctly prefixed in the second case. Why?

---

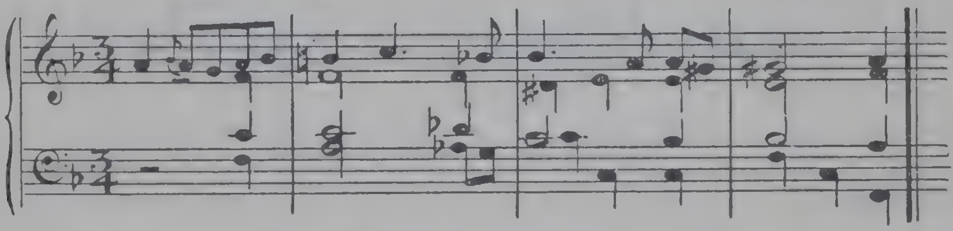
[1] One ought also to mention the converse procedure in which the dissonant note itself stands still whilst the other parts move into harmony with it. This is however rare by comparison.

The answer is of course to be found in the order of rhythmical occurrence of the various chords. No. 1 starts and finishes with an emphatic statement of C, No. 2 with a no less emphatic statement of G; No. 1 rounds off its four bars with a well-defined perfect cadence in C, No. 2 with a scarcely less powerful plagal cadence in G. In other words, one has to interpret the harmony in the light of the rhythm. The elements of music are not isolated in practice as they may be in theory; even in the construction of such short and simple sentences as those above, it is not the harmony alone which controls, nor the rhythm alone, but the two acting in collaboration.

There is, however, one single chord which of itself can define a key—the chord of the dominant seventh. Consider that chord in the key of C—G B D F. The F shows it is not G or any of the "sharper" keys, for these would all require F♯. Similarly the "flatter" keys—F, B♭, etc., would all require B♭. Therefore C alone remains. Even A minor, the relative minor, requires a G♯ as leading note for its clear definition although G♮ frequently occurs as a diatonic note in that key. Therefore, when the dominant seventh of any key is sounded, particularly when closely preceded or followed by the tonic of that key, modulation results automatically, even though it be immediately contradicted by a new modulation or by a return to the original key. Apart from this, one has to trust for guidance to one's key-sense, not to any rule of thumb.

One further caution should be given. Accidentals of themselves do not necessarily indicate modulation, as might be supposed. Passing notes and unessential notes may be chromatic as well as diatonic. These have to be indicated by accidentals, and as they are of very frequent occurrence it follows that a passage may fairly bristle with these little signs and yet never stir out of its original key. Here is a sample :—

Ex. 37.



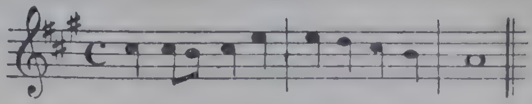
Nothing but F major here; whence it may be gathered that key-spotting is rather a tricky business until you are used to it.

4

Texture

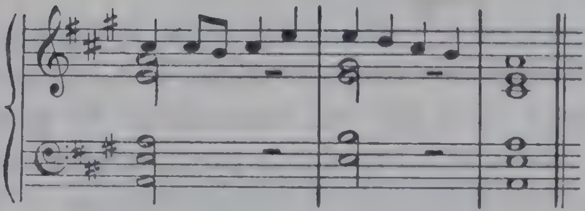
By the "texture" of a piece of music is meant the interweaving of the inner parts. Sometimes these are as interesting and vital as the melody itself: the piece would then be said to be "contrapuntal" in character or to present interesting contrapuntal features. Sometimes they serve merely to complete the chords necessary to support the principal notes of the melody, in which case the piece is described as "harmonic" in structure. To this antithesis between "harmony" and "counterpoint" we will return a little later; meantime an example will serve to make plainer what is meant by the " texture " of music. Take this fragment of melody :—

Ex. 38.

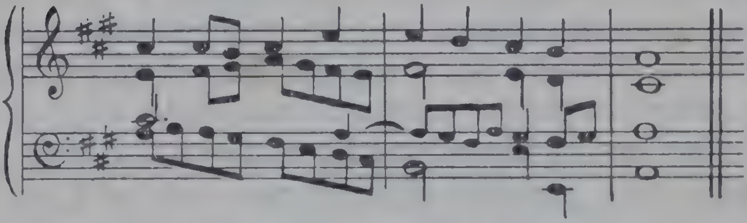


Here are two ways of treating it, offering the strongest possible contrast :—

Ex. 38A.



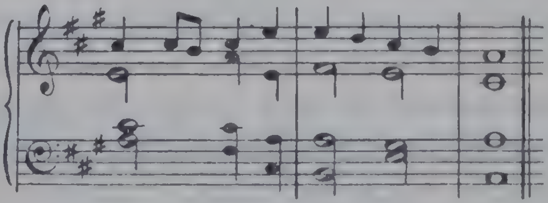
Ex. 38B.



In the first of these the texture is the loosest possible; indeed you cannot properly speak of " texture " here at all. There is no trace of melodic or rhythmic interest anywhere except in the top part; there are only block chords, and those of the fewest and simplest character that will support the melody; the treatment in short is purely harmonic. In the second, all the parts have an equal interest and independence of character, and the treatment therefore is essentially contrapuntal.

This illustrates the common saying that harmony is music regarded *vertically*; counterpoint is music regarded *horizontally*. They are not necessarily two different things so much as two different ways of looking at the same thing. Admitted that you can have harmony without counterpoint—Ex. 38A above is an extreme case in point. *But you cannot have counterpoint without harmony*.[1] Take Ex 38B, cut out all the passing and unessential notes, and reduce it to its simplest harmonic form :—

Ex. 38B.



This, considered purely as harmony, *i.e.* as a top part supported by vertical blocks of chords, is at least as satisfactory and logical as Ex. 38A; if it were not so, the counterpoint of Ex. 38B would also not be felt as logical and satisfactory. Nevertheless the chords result from the counterpoint; and yet they are a vital factor in deciding the course of that counterpoint. Each determines and is at the same time determined by the other.

---

[1] I speak, of course, of classical counterpoint, not of the so-called " linear counterpoint " of our own time. Of this more in Part II.

Let us now consider how all this bears on the question of orchestral treatment. Harmony text-books present all these questions very largely from a vocal standpoint, and up to a point they are quite right in doing so, for by this method all extraneous questions are excluded and the student's mind is thus left free to concentrate on the simplest and most fundamental problems of harmonic progression and clear part writing, which he must master first of all. But one has only to open any page at random of a full orchestral score to see that it does not look in the least like any of the musical illustrations in the harmony book. There is a gap somewhere, and we must endeavour to bridge it.

First of all look back once more at Ex. 38A. It is obvious that this type of harmonic procedure is not very practical. You cannot assemble a huge orchestra together and then ask one instrument or group of instruments to play the melody while the rest from time to time ejaculate such notes as are necessary to give that melody the minimum of harmonic support. Such treatment is only possible occasionally and in small doses[1]; keep it up for any length of time, and the players who have not got the tune to play will die of boredom, to say nothing of the audience.

On the other hand, the purely contrapuntal kind of texture shown in Ex. 38B is also not of more than limited use for orchestral purposes. In the first place the number of parts that can well be combined in this fashion is not more than four or five at the most; above that number they lack proper manœuvring space, with consequent overcrowding and congestion. In the second, to make such a passage effective, each part must be of equal clearness and resonance, and must therefore be played by an instrument or instruments of equal power and mobility. Now of the three chief orchestral groups—strings, woodwind and brass—the strings can quite overpower the woodwind in a forte passage, and also dwindle far below them when a pianissimo is required. The brass, on the other hand, are superior to the other groups in blare and penetrative power, but immeasurably behind them in mobility. They could not attempt a passage like this without making themselves ridiculous; indeed, the passage is really suitable only for a homogeneous group of strings, or an equally homogeneous group of woodwinds, or a mixed group in which each line of strings is doubled at the unison by one or more of the woodwinds. Any of these methods would become wearisome after a short time, the last one particularly so, on account of the mixed timbres employed. It is a cardinal principle of good orchestration to make the fullest use of the pure unblended tone-colour of each orchestral group, and also of each individual tone-colour within that group—flutes, oboes, horns, trumpets, violas and so on.

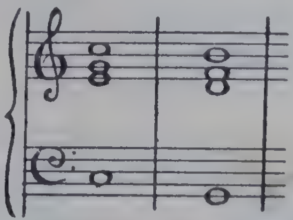
Therefore, the orchestra has had to evolve other methods of tone-combination, and the most important of these by far is that of *rhythmical figuration*. This enables a composer to give all his instruments in turn plenty to do without necessarily bringing them prominently into the foreground, and without those frequent changes of the essential harmony which a strictly contrapuntal texture usually involves. Music moves more lightly when there are only one or two essential chords in a bar than when there are four. Let us examine in rather more detail how this kind of texture is contrived.

---

[1] See, for example, the opening theme in the finale of Dvořák's *New World* Symphony, which is precisely so treated, with a tremendously powerful effect.

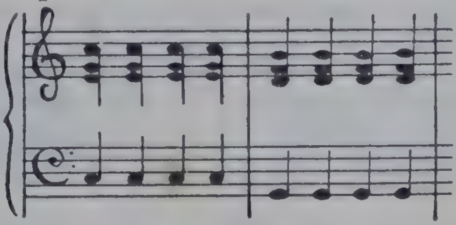
Take as a starting-point two of the simplest of all the chords—the tonic and dominant seventh of C major :—

Ex. 39.



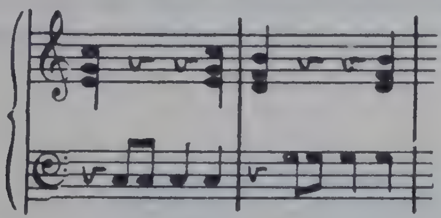
Harmonically there is no difference whatever if we write each bar as 4 crotchets instead of 1 semibreve :—

Ex. 39A.

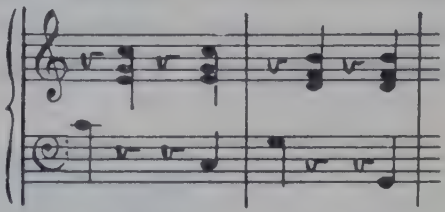


Clearly, too, these can equally well be changed into quavers or semiquavers, or a combination of both or of all three, without affecting the basic harmonies in any way. Or again, rests and ties may be used in certain places instead of actually repeating the chords :—

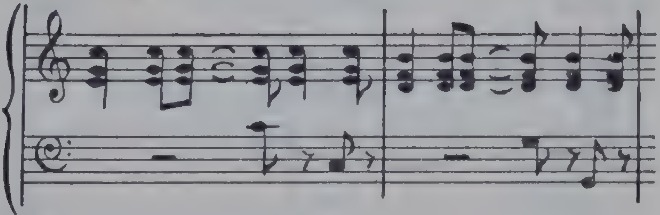
Ex. 40.



Ex. 41.

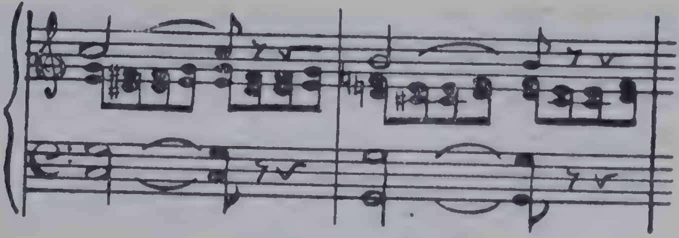


Ex. 42.

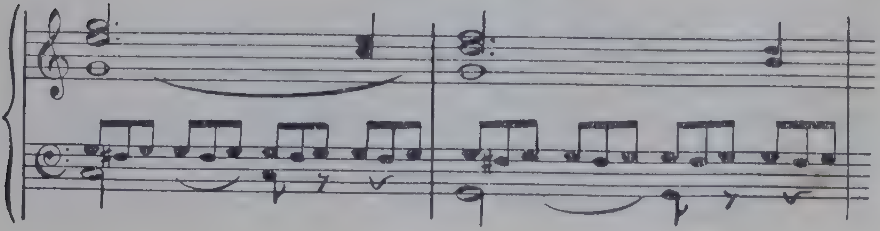


Moreover, such figures can easily be varied and amplified by the employment of unessential notes :—

Ex. 43.

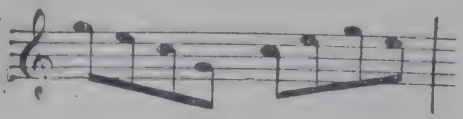


Ex. 44.

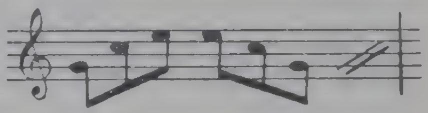


Nor must we overlook the endless varieties of *arpeggio*—*i.e.* figures in which the notes of the chord are sounded in succession instead of simultaneously. (The sign // means that the figure is repeated to form the second half of the bar) :—

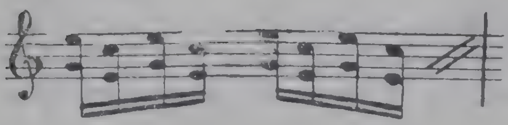
Ex. 45.



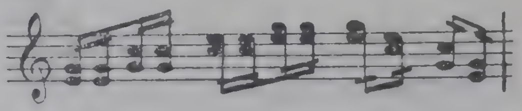
Ex. 46.



Ex. 47.

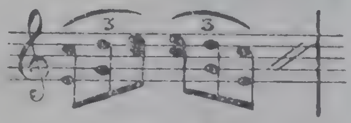


Ex. 48.

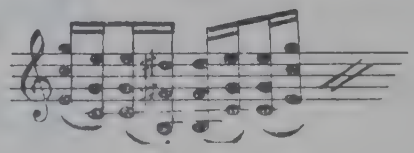


These also may be elaborated by the addition of unessential notes :—

Ex. 49.

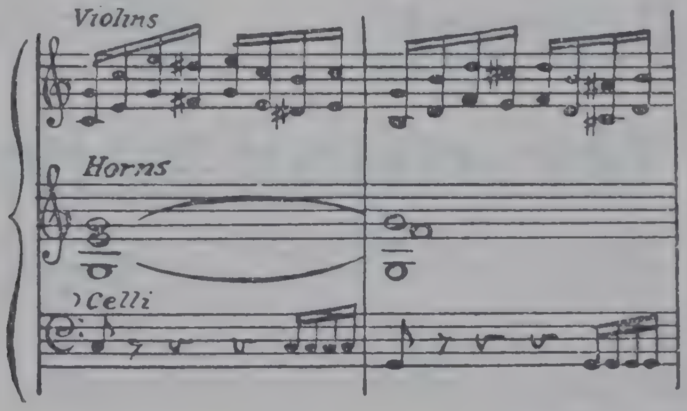


Ex. 50.



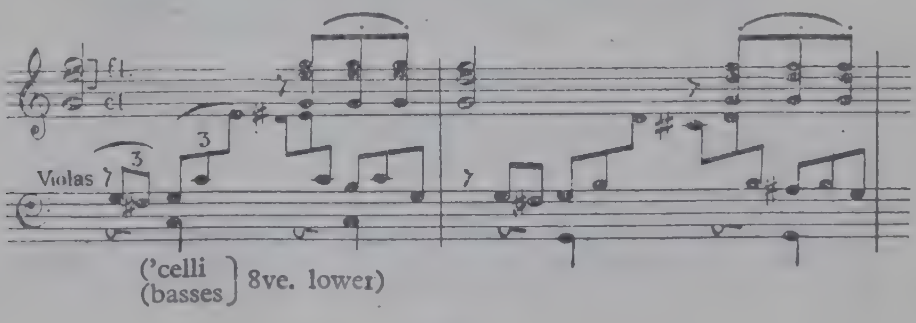
Moreover different types of pattern may be combined in different instrumental groups playing in different registers ; for example, the horns may sustain all or some of the chord in the background, whilst the upper strings play a rapid arpeggio or tremolando, the lower strings picking out the essential bass notes in some form of rhythmical punctuation. (In such a case we may imagine the melody being assigned to the woodwind, rather high up, in octaves) :—

Ex. 51.



Or the woodwind may hold and repeat the chord, the violas play a simple arpeggio in triplets (groups of three notes) while the basses punctuate as before. (In this case the melody would probably be assigned to the upper strings) :—

Ex. 52.



There is no end to the possible variety of such figures; they are the stock-in-trade of every orchestral composer. What I should like to emphasise here is the immense importance and significance of the rests; not only do they vitalise the harmony by infusing into it the element of rhythm, but they afford immense relief to the ear by lightening the texture. Without rests there would be a continuous blur of sound from every instrument participating in any given passage; the ear would quickly become fatigued and the melody would be unable to stand out in strong relief against the background of accompaniment, as it often wants to do. It is only thanks to the rest that orchestral music is saved from an all-pervading heaviness and dullness of sound—a point which even professional students are often curiously slow to realise.

Here we may leave the question of texture. It seemed worth while to embark on this brief discussion of it, because it really is difficult for the layman to understand, without some help, how the apparent complications of an orchestral score can be reduced to such very simple terms. Even if he is sufficiently interested to consult the text-books, he is probably no better off; the harmony books take him so far, and then he finds that the orchestration books start from quite a new point of departure. The object of this discussion has been to make the transition easy, and to show how the simple 3- and 4-part chords of harmony have to be re-spaced and broken up in order to form the actual stuff of composition, and of orchestral composition in particular. The illustrations chosen are simple to the verge of naïveté, and have deliberately been made so to serve this particular purpose.

5

Design: First Principles

Music—civilised music at any rate—has always realised the need of *unity*, *i.e.* of some principle or principles of design by virtue of which the piece may be recognised as a single coherent whole, and not as a mere succession of sounds beginning at random and ending where they will. Even in the simplest folk-songs and dances we commonly find three such principles in operation:—

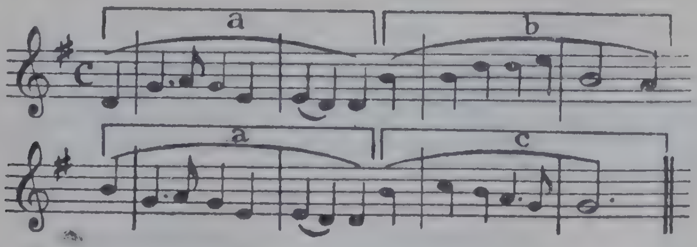
(1) Unity of key.

(2) Balance of phrase and sentence.

(3) More or less extended use of sequence or pattern to reinforce (1) and (2).

To illustrate this, take first of all a very short and simple folk-tune, "Abroad as I was walking":—

Ex. 53.

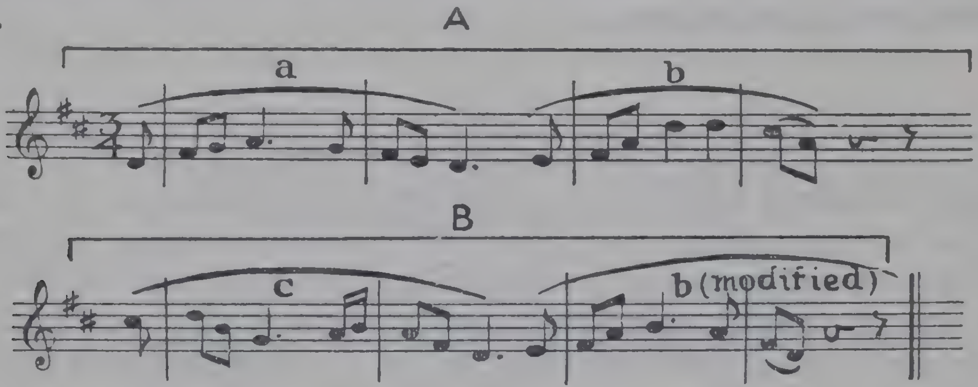


Here is a tune which clearly consists of 4 units or phrases; the opening phrase (2 bars) is followed by a phrase of contrast (also of 2 bars); then the opening phrase is repeated, and followed by a new contrasting phrase which completes and rounds off the whole. This period of four phrases could be represented diagrammatically by the letters *a b a c*, *a* being of course the opening phrase, which occurs twice. This may fairly be considered a representative type of structure; the balance is by no means always so exact as this, but a surprisingly large proportion of folk-tunes and popular tunes will be found on examination to contain structural features of this kind. The diagram is of course not always the same—you may find *a b b c*, *a b c a*, *a b c b*, *a b b a*, and so on. These are of what is called "binary" structure, because they consist of two (more or less equal) halves or sentences, each pair of units or phrases combining into one sentence ($a^1b \parallel a^2c$). In more elaborate melodies there is often repetition of sentence as well as repetition of phrase, so that your diagram becomes (*e.g.*) $a^1b \parallel c^2c \parallel a^3b$. Such structure is called "ternary" or threefold. It is often referred to briefly as "A B A" form; in this context, of course, the letters A and B denote, not phrases, but sentences. To prevent possible confusion, it may be taken throughout this Article that the small letters, when used thus diagrammatically, denote phrases only; the capital letters represent sentences or larger units.

To illustrate these contrasting types, binary and ternary, two examples of each are subjoined, each a very well known tune and each presenting certain interesting features in the details of its phrase construction:—

(1) "Barbara Allen" (binary):—

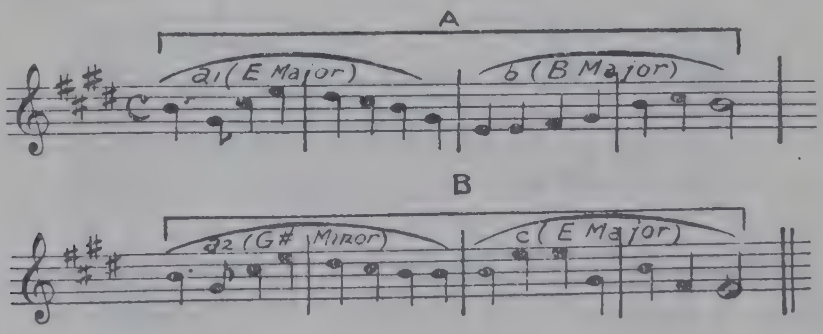
Ex. 54.



The general type here is $a\ b_1 \parallel c\ b_2$; at b_1, there is a half-close on the dominant; b_2 is modified so as to close on the tonic, whilst preserving the essential contour of b_1; moreover the whole is unified to a remarkable extent by the prevalence of a single rhythmical pattern, which is modified just enough to prevent any feeling of monotony.

(2) "Through the night of doubt and sorrow" (binary):—

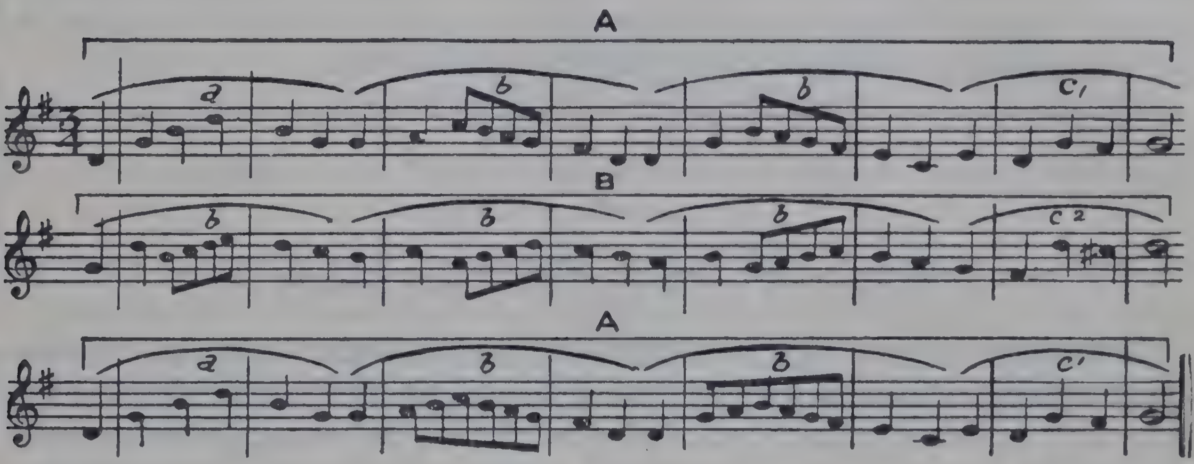
Ex. 55.



Here the type is $a_1 b \| a_2 c$. The tune is a harmonised tune, which will be found in full in *Hymns A. and M*. Here we quote the melody only, showing the modulations that occur to provide variety of key as well as variety of melodic outline. a_1 is in E; recurring as a_2, it is in G♯ minor, thus providing unity and contrast at the same time.

(3) "The Ash Grove" (ternary) :—

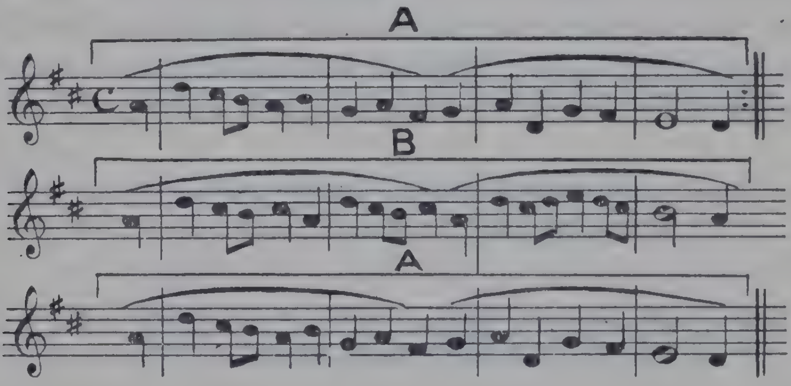
Ex. 56.



Here A, the first limb of the ternary structure, is itself binary in form, as very often happens, the pattern being $a \; b_1 \| b_2 \; c$. Here b_2 is not an exact repetition of b_1, but a sequential reproduction of it one tone lower. B is even more sequential in structure, the opening phrase being thrice repeated on descending degrees of the scale, and rounded off by the repetition of *c*, borrowed from A, and put into the dominant key. Moreover the phrase thrice repeated is in itself an inversion of *b*, so that there is development as well as pattern to maintain our interest. Altogether a very neat little piece of workmanship.

(4) "The Vicar of Bray" (ternary) :—

Ex. 57.



Again quite a straightforward ternary tune, constructed of symmetrical two-bar phrases. The important things to note are (1) the opening strain is repeated; (2) the contrasting strain—B—is not formed of new material, but by developing the rhythm of the opening bar of A. Thus the scheme in detail is seen to be :—

(4+4 bars) (1) *Exposition* of principal strain, closing with double bar and then repeated.

(4 bars) (2) *Development* of principal strain so as to form a new strain of sufficient length to balance the exposition, and asserting a new key (A major).
(4 bars) (3) *Recapitulation* of original strain.

This archetype has great significance for musical history ; it has been found (unlike the binary form) to have almost indefinite powers of expansion, and is in fact precisely the same in its basic outlines as the so-called " sonata " form which dominated music from about 1770 onwards for more than a century and is by no means dead yet.

6

Design : The Early Suites and Sonatas

Both these simple types—binary and ternary—are found in a somewhat expanded form in a great deal of the music of the later seventeenth and early eighteenth centuries. In vocal music, the ternary influence was at first the stronger ; in instrumental music, the binary. Before we consider how these primitive song-patterns were thus adapted to form the internal structure of more extended instrumental movements, some general explanation should be given of the titles " Suite " and " Sonata " which we find affixed to so many collections of these movements.

First of all, the Suite. This is merely a collection of pieces, mostly in dance form, arranged so as to form effective contrasts of time, pace and style, and unified as a whole principally by a common key ; there is little or no inward connexion between the separate movements of a Suite, such as one often feels between a prelude and its fugue, or between the several movements of a modern symphony.

There is no fixed number of movements in a Suite ; nor are they arranged in any fixed order, except that the allemande usually comes first and the gigue (or " jig ") last. Typical movements, some or all of which are pretty certain to be found in any Suite, are as follows :—

Allemande ..	Common time, fairly fast : even and flowing in character.
Courante (Italian form) ..	Triple time, with continuous rapid quaver or semiquaver movement.
Courante (French form) ..	$\begin{smallmatrix}6\\4\end{smallmatrix}$ or $\begin{smallmatrix}3\\2\end{smallmatrix}$ time, or an irregular alternation of both ; not such a lively pace as the Italian courante.
Minuet ..	$\begin{smallmatrix}3\\4\end{smallmatrix}$ time, graceful but at the same time dignified in character—essentially a " courtly " dance.
Sarabande ..	$\begin{smallmatrix}3\\4\end{smallmatrix}$ time, slow and dignified. Sometimes repeated once or twice with simple variations, known as " doubles " or " agréments."

Gavotte	$\genfrac{}{}{0pt}{}{4}{4}$ time ; fairly quick ; starts usually on the 3rd beat of the bar. The gavotte is sometimes followed by a " musette "—a piece so-called from an old-fashioned instrument of that name (a kind of bagpipe), because the musette is written over a drone bass such as is always heard beneath a bagpipe tune.
Bourrée	$\genfrac{}{}{0pt}{}{2}{2}$ time ; quicker than the gavotte ; starts on the fourth crotchet of the bar.
Jig (Giga, Gigue)	$\genfrac{}{}{0pt}{}{3}{8}$ or some compound time ; very lively and energetic in character.

Various other dance-forms occur from time to time, but it is not possible to enumerate or describe them all in such a brief outline as this. One should add, however, that " Partita " and " Ordre " are roughly speaking synonyms for " Suite."

Second, as to the Sonata. The term had in these early days quite a different meaning from that which it acquired later and which will be explained in the following section. It meant simply " something to be played " as distinct from a Cantata, which meant " something to be sung " ; it consisted usually of four movements (slow, fast, slow, fast), many of which were contrapuntal in character and derived directly from the old-time canzonas and fugues (see section 8, where the contrapuntal forms are briefly described). A reference to the article " Sonata " in Grove's *Dictionary* will show the impossibility of covering the subject in a few words. The real point here is that these early Sonatas do also contain many movements that are definitely binary or ternary in form, and are to that extent similar in their internal structure, though not necessarily in their style or rhythm, to the movements of the Suite. This is particularly true of the so-called " Sonata da Camera " (chamber Sonata) which was of a lighter and less austere character than the " Sonata da Chiesa " (church Sonata).

So much for the generic terms " Suite " and " Sonata." We now have to show exactly what is meant by describing their individual movements as " binary " or " ternary " in form, for it has already been implied that these movements, short as they are, are considerably longer and more elaborate than the folk-song types analysed in section 5.

In the binary movements, the first thing to be explained is the key-system. A typical binary movement falls into two halves, separated by a double bar, each half being repeated. The first half starts, of course, in the tonic, modulates fairly soon, and closes at the double bar with a cadence in some closely related key—the dominant or (if the principal key is minor) the relative major. The second half starts out in the new key, modulates again, rather more freely, and eventually returns to the tonic, which is then re-asserted at sufficient length to restore its predominance as the principal key of the movement.

This unity of key structure is re-inforced by the use of the thematic material. There need be no exact repetition, but at the opening of the second half there is commonly a reference to the opening of the first, either directly or—very commonly in Bach—by melodic inversion. The final cadence also is usually a reproduction in the tonic of the cadence heard at the double bar, and of the phrase which leads up to it. In between these, moreover, there are usually periodic references to the rhythms and melodic outlines of the first half, so that the whole is felt as balanced and coherent, even though there is no exact thematic repetition, and though the two halves are not of equal length (the second contains more modulation and is therefore as a rule rather longer). If one wishes to represent the form diagrammatically, it may be done as follows :—

$$: A_1 — B_2 : \| : A_2 — B_1 :$$

the numbers representing the keys, the letters the opening and closing phrases of the melody.

The ternary movements are similar to the binary in the arrangement of the keys and modulations, and in the general use—incidental rather than systematic—that is made of the thematic material. Where they differ is that in the second half, when the return is made to the tonic key, there is at the same time a return to the opening strain of the movement, which is then repeated, in whole or in part, in its original key.

(*N.B.* Some authorities do not consider that such a partial recapitulation justifies one in classifying a movement of this kind as " ternary " ; but for my own part I cannot see it in any other way, for a return to the opening theme in the opening key after a series of contrasts is surely the very essence of ternary form. I have therefore set down my own view of the case, with this warning that it is not universally upheld.)

7

Design : The Symphonic Form

The usual nomenclature of musical form as a whole conceals a perfect labyrinth of cross-divisions, and thereby gives rise to a great deal of misunderstanding and confusion. To depart from the usual nomenclature here would only make this confusion worse confounded ; for better for worse we must adhere to the customary names, and at the same time endeavour to show clearly where misunderstandings are liable to arise.

First of all, let us define " a Sonata " provisionally as an extended piece of music for not more than two solo instruments, in three or four movements, of which one or more exhibits a certain definite type of structure known as " Sonata form " or " first-movement form." What this type of structure is will be presently explained.

Second, let it be understood that " a trio," " a quartet " (quintet, sextet, etc.), is a precisely similar piece written for three, four, or more solo instruments—in fact, a Sonata for more than two solo instruments, the name being derived, not from the style or structure of the piece, but from the medium for which it is written. This description has to be further qualified by adding the names of the particular instruments involved—*e.g.* " Trio for pianoforte, horn and violin," " Quartet for two violins, viola and 'cello " (the usual " string quartet "), and so forth.

Thirdly, " a Symphony " is again a piece of similar dimensions and construction composed for full orchestra.

Therefore, in heading this section " The Symphonic Form," what is indicated is a *brief* outline of the structure commonly found in the several movements of a classical Symphony; from what has been said above, it will be understood that the structural outline of a sonata, trio, quartet, etc., is precisely the same. The word " brief " is purposely emphasised; there is no room here to enter into the thousand and one little devices and expedients by which this form is endowed with almost inexhaustible variety.

The first movement. This is commonly in so-called sonata-form—an immensely amplified " ternary " type, in which distribution of key is carefully planned so as to emphasise at first the contrast between the principal themes, whilst paving the way later for a reconciliation. The three limbs of the structure are known as :—

(1) Exposition (sometimes preceded by a slow Introduction).
(2) Development.
(3) Recapitulation—a repetition of the Exposition, with certain modifications, and rounded off by a Coda.

The details of the analysis are as follows :—

Exposition

(1) Announcement of principal subject in tonic key. Modulations in this section are of a transitory nature; it is the tonic that must first be strongly asserted.

(2) Transitional (or " bridge ") section, in which the influence of the tonic is gradually weakened, until finally some new key (not, however, too remote from the tonic)[1] is established.

(3) Announcement of secondary subject (or more accurately, group of subjects) in the new key, which thenceforward prevails until the end of the exposition. (In the earlier symphonies the exposition closes with a double bar and repeat; later, it passes without break into the development.)

Development (also known as " free fantasia " or " working-out section ")

The themes already announced are " developed " in various ways—*i.e.* characteristic rhythmic or melodic features are presented in various new guises and combinations, according to the fancy and ingenuity of the composer. Modulation is frequent and remote keys are often reached. There is no sort of rule as to the order of presentation; in the first movement of Beethoven's 8th Symphony, for example, the development is concise and based entirely on one single figure, taken from the principal subject; in the *Eroica* practically the whole of the thematic material is trotted out and made to show its paces in a development of unprecedented length and elaboration.

---

[1] In the earlier symphonists—Haydn, Mozart, and at first Beethoven—the new key is almost invariably the dominant or (if the original key was minor) the relative major. Subsequently Beethoven allowed himself a wider range of secondary keys, and later nineteenth-century symphonists followed his example.

Recapitulation

Same as the exposition, but this time the tonic key prevails throughout, both for principal and secondary subjects. The Coda may be quite brief, or it may attain imposing dimensions—in Beethoven's *Waldstein* Sonata, for example, and (once more) in the *Eroica* Symphony, it is virtually a new " development " section ; it depends generally on the proportions of the movement as a whole.

Slow Movement

This is cast on various lines :—

(1) First-movement form complete. Rare on account of its length, but nevertheless found occasionally—*e.g.* Beethoven Symphony No. 2 in D ; pf. Sonatas in B♭, op. 22 and 106.

(2) Abbreviated first-movement form—*i.e.* sonata-form with the development section omitted, the exposition either leading straight back into the exposition (like a serpent swallowing its own tail), or being linked to it by a few transitional bars. This is Mozart's favourite form for the slow movement ; cf. also Beethoven, pf. Sonata in D minor, op., 31 No. 2. (This type of movement is of course an enlarged " binary.")

(3) Enlarged ternary form with Coda. Here each limb of the threefold structure is itself a complex unit, very likely a complete binary or ternary stanza. This is much favoured by Beethoven in his earlier piano Sonatas.

(4) Some form of episodic structure, in which a central theme recurs from time to time with episodes of contrasted style and key in between—in fact, a Rondo (to be explained when we come to discuss the last movement). Common in Haydn, and found also in Beethoven (4th and 5th Symphonies ; Sonata in C minor, op. 13).

(5) Theme and variations (described more fully in section 9). Less common than the others, but by no means unknown (Haydn, *Emperor* quartet ; Beethoven, quartet in C♯ minor, op. 131).

Minuet or Scherzo

The difference between these two is one of pace, mood, and style ; both are alike in form, which is most often ternary, the Minuet or Scherzo being followed by an intermediate section (" trio ") and then repeated in its entirety. Sometimes the trio is itself repeated, and then followed by yet another re-statement of the principal section ; or there may be a second trio, in which case the movement as a whole becomes a Rondo.

Last Movement

There are various alternatives—sonata-form (common) ; variation-form (Beethoven, Sonatas, op. 109 and 111 ; Choral Symphony ; Brahms, Symphony in E minor, op. 98) ; fugue (Beethoven, Sonatas, op. 106, 110).

Very often it is a Rondo—*i.e.*, as already stated, a movement in which the principal theme recurs from time to time, plain or varied, with contrasting episodes in between.

There are two principal types of Rondo which may be diagrammatically rendered as A B A C A and A B A C A B A respectively. The shorter form is the one commonly employed by Haydn and the earlier eighteenth-century composers; the longer is Beethoven's invention, and is due no doubt to his desire for a Rondo of sufficient length and importance to balance the other movements of a Sonata, which he also greatly enlarged, in comparison with his predecessors. Both types may be seen side by side, as though to invite comparison, in the Sonata in C minor, op. 13 (the so-called " Sonata Pathétique "), where the slow movement and the finale are both Rondos, of the shorter and longer type respectively.

(*N.B.* Sometimes, in the longer form, the section C, instead of containing new material, consists of a development of themes heard in the earlier section. The form then becomes identical with ordinary first-movement form, except that the development section is preceded by a whole or partial re-statement of the principal subject in the tonic key. This is known as " modified rondo " or " rondo-sonata " form.)

It will thus be seen that a Symphony or Sonata is a highly complex affair, in which movements of strongly contrasted pace, mood, and style have somehow to be realised as a unity. In some of the later symphonists—more especially Liszt and Berlioz[1]—a single theme re-appears in various guises and rhythmical transformations throughout the entire course of a work. Such attempts at thematic unification are not wholly successful. The underlying unity of so multiple a structure as a Symphony is something to be felt rather than analysed; it is a psychological reality which seems to be in no way dependent on thematic transformation of the Liszt-Berlioz type. It is, in short, a mystery, and the success with which it is achieved is the measure of a composer's greatness. To impose a spiritual order upon this dramatic welter of conflicting emotions is the work of a giant. It is just in virtue of this inward mastery that Beethoven overtops all other Symphonists. Others may approach or even surpass him in formal perfection, romantic charm, or certainty of orchestral technique, but in sheer creative power he remains by common consent the greatest of them all.

8

Design : The Contrapuntal Forms

Counterpoint, as we have seen, is a term that applies properly to texture rather than to design, and some authorities would consider it a confusion of categories to talk of " contrapuntal forms," when the contrapuntal texture can be wrought into almost any form. Certainly it is a misnomer to call the finale of Mozart's *Jupiter* Symphony (as it often is called) " a fugue." The texture is consistently contrapuntal, but the outlines are cast unmistakably in sonata-form; that is to say, in the order of presentation and development of the themes, and the system of key-distribution, the work follows the perfectly normal course of a symphonic movement, although the way in which the subjects are combined, inverted with one another, and generally manipulated, is fugal rather than symphonic in the ordinary sense. And since Bach, at any rate, the term " fugue " has consistently denoted a certain kind of outline as well as a certain kind of texture, so that a brief description of that outline must here be given.

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[1] Partial application of the method is also to be found in Dvořák's *New World* Symphony and César Franck's Symphony in D minor.

A fugue, then, is built up from one principal theme (the " subject ") and commonly falls into three main divisions : Exposition, Middle Section, Final Section. The last is sometimes called " Recapitulation " ; this is a complete misnomer, for there is no recapitulation in a fugue. Bach tried it once or twice, and the result is not fully convincing, especially in the organ fugue in E minor (the so-called " Wedge "), where one feels that a fine subject has been thrown away. *The fugal process is essentially discursive and continuous.*

The order of the exposition is as follows :—

Each voice enters in turn, with the subject and answer usually alternating in tonic and dominant keys. When the first voice has announced the subject, the second gives the answer, whilst the first carries on with what is known as the *Counter-subject*—a term which explains itself. When the last voice to enter has finished its announcement of the subject, the Exposition is, strictly speaking, complete, although it is occasionally followed by a few transitional bars before the middle section proper begins, and these few bars are often included by convention as part of the Exposition. Such differences of detail are unimportant—they are differences of terminology, not of substance. Nor need we concern ourselves here with technical points such as the distinction between " real " and " tonal" answers : suffice it that sometimes the answer is an exact transposition of the subject, sometimes it is slightly modified.

Before we pass to the middle section, two points should be mentioned :—

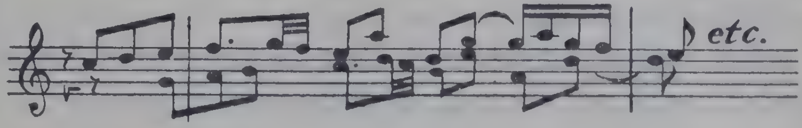
(1) In the strictest type of fugue the counter-subject accompanies the subject in all its appearances throughout the entire course of the fugue. (This strict type is rare ; No. 2 in Book I. of Bach's " 48 " is an example.) Subject and counter-subject must of course " invert " readily—*i.e.* they must sound equally well whichever is uppermost. Subjects that invert in this manner are said to be " in double counterpoint." Sometimes a fugue has two or more counter-subjects, all of which invert in this manner with one another and with the principal subject ; they are then said to be in triple (quadruple, etc.) counterpoint. (See Bach, " 48," I. 4 and II. 17 for extremely fine examples of triple counterpoint.)

(2) Sometimes the exposition is followed by a whole or partial " counter-exposition," in which subject and answer again succeed one another in tonic and dominant keys, though the order in which the several voices enter is generally different.

Middle Section. This is the main body of the fugue ; the subject enters from time to time in its original form, but with a wider choice of keys. In between these " middle entries," as they are called, come short episodes or developments, usually founded on some characteristic phrase or rhythm of the subject or counter-subject, but often also incorporating new figures or features of interest such as augmentations, diminutions, strettos, etc. Moreover the episodes are themselves often written in double counterpoint, a new episode being formed by the simple process of inverting an earlier one.

(*N.B.* " Augmentation " and " diminution " mean respectively doubling and halving the note-values of the theme. " Stretto " means overlapping of the theme—*i.e.* the announcing of it by a new voice before a previous announcement is complete, *e.g.* :—

Ex. 58.



Sometimes fugues are written almost entirely in stretto, *e.g.* " 48 ", I. 1 ; II. 5. In such cases the subject has everything its own way ; there is usually no counter-subject and few episodes if any.)

Final Section. Shorter than the other two, and generally indicated by a return to the tonic key. Apart from this, it is difficult to give any set description of this section, and in many cases difficult even to say exactly where it begins, so continuous a thing is a good fugue. Its chief function is to restore the predominance of the tonic key after all the excursions and modulations of the Middle Section. To this extent it is certainly analogous to the " recapitulation " of a Sonata, but to give it that title is extremely misleading, as already observed.

Before passing on to the other contrapuntal forms, two special types of fugue should be mentioned—the double fugue and the fugue on a chorale, although the latter is often classified as a special type of chorale-prelude (see below).

A double fugue is a fugue on two subjects. Sometimes these are announced simultaneously, in which case it closely resembles an ordinary single fugue, except that the counter-subject is elevated to a rank of equal dignity with the principal subject. Sometimes each subject is given a separate exposition and development, after which they are heard in combination in the final section (a spacious and attractive lay-out; cf. " 48 ", II. 18).

A fugue on a chorale is a fugue in which a chorale (old German hymn-tune) is superimposed, line by line, upon an ordinary three- or four-part fugue which pursues its own independent and continuous course underneath it.[1] There is also a shorter type in which the fugue instead of being continuous is built up of a series of short fugal expositions, the theme of each exposition being the opening notes of each successive line of the chorale usually (but not necessarily) in diminution. Examples of both kinds can be found in Bach's organ works—*e.g* *Kyrie Gott Vater* (first type) and *Durch Adams Fall* (second type).

Closely akin to the fugue, but less strict, are the *Invention* and the *Canzona*. Both are terms of somewhat loose connotation, and there is no need here to enter into details of the unimportant technical modifications which they present. Either can safely be taken on trust by the layman as " more or less a fugue."

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[1] Or above it, or around it, if the chorale is assigned to the bass or to one of the inner voices.

Canon merely means perpetual fugue—that is to say, continuous imitation of one voice by another throughout a movement, or throughout an entire section of it. It is not necessary that all the voices should participate in the canon; very often the canon is limited to two voices, the other parts pursuing an independent course. The imitation may be at any interval, and at any distance within reason—that is to say, the answering voice may enter a bar after the leader, or two bars, or half a bar (it is usually one or other of these).

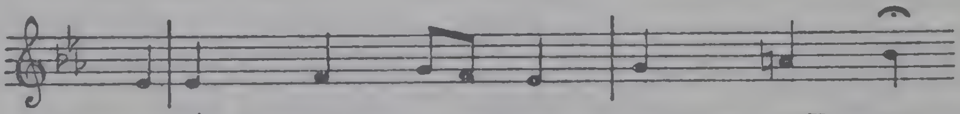
The only other contrapuntal form that need be here described is the *Chorale-Prelude*. There are three principal types of this :—

(1) It may be a special type of fugue (v.s.).

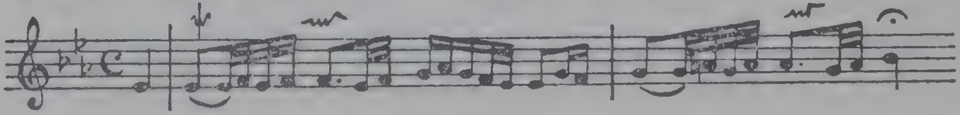
(2) The chorale may be given line by line to one voice (as in the fugal type) whilst the other voices are assigned, not a fugue, but free counterpoint of a more or less imitative character usually based on some definite and persistent rhythmical figure. Sometimes the successive lines of the chorale follow one another without a break (as in Bach's "Little Organ Book"); sometimes there is a long interval between each line, during which the accompanying voices carry on their counterpoint alone (*e.g.* the familiar *Wachet auf*). Naturally the second type is considerably longer and more elaborate.

(3) The melody of the chorale may be ornamented and embroidered—often to such an extent that it becomes a veritable arabesque, in which the original outlines of the tune are scarcely perceptible at a casual hearing. A glance at the opening notes of *O Mensch, bewein'* and then at the opening of Bach's Chorale-Prelude bearing the same title will serve to illustrate the process :—

Ex. 59.



Ex. 59A.



In this type the underlying voices are not in themselves of special interest; their chief purpose is to supply appropriate harmony to the melody above them, though they still retain a certain independence of character and must not be regarded merely as a series of chords. The type is perhaps inferior to the other two in quality of texture, but certainly not in essential beauty—if in the world of music there exists anything lovelier than *O Mensch, bewein'* or *Herzlich tut mich*, I have yet to discover it.

9

Design : Variation-form and the Concerto

Variation-form remains to be discussed; and something must also be said about the Concerto, for although this last is a medium and not a form *per se*, yet it is a medium which imposes certain definite modifications upon whatever form is adopted.

We may approach variation-form most easily by posing the question, What precisely is the relationship that exists between a theme and its ensuing variations? We know that they are different, otherwise they would not be variations; but in what respect and to what extent are they the same?

To this question there are several answers:

(1) The melody of the theme may be kept virtually intact, whilst the accompanying harmonies are altered and the texture elaborated—as in many of Delius' "Brigg Fair" variations.

(2) The melody may merely be transferred to the bass or to an inner part, as in the first and third of Brahms' variations on a theme by Schumann (op. 9).

(3) The theme may be decorated and embellished, as often in Schubert—*e.g.* the first variation in the slow movement of his string quartet in D minor.

(4) Some characteristic figure or rhythm of the theme may be taken and worked up into a kind of independent study, persisting more or less throughout the variation, whilst the essentials of the harmonic structure are preserved in their original form. Very common.

(5) Sometimes the figure is not even taken from the theme at all, the harmonic and structural outline being relied on to give the necessary connexion. It should be noted furthermore that the harmonic reproduction is often limited to the most important progressions, cadences, and points of colour; it is seldom a chord-for-chord correspondence.

(6) The opening of the theme may be treated contrapuntally—either in a set fugue or in the freer kind of imitation known as *fugato*.

(7) Changes of mode (minor for major) and/or of time may accompany all or any of the above.

It is essential that in handling this form the composer should play fair with his listener, by adhering faithfully to the harmonic and structural outlines of the theme and also by reminding him from time to time of the theme itself. It is very easy to lose one's bearings when listening to an elaborate set of variations, a fact which the composer does not always remember. Brahms is especially scrupulous in this respect: the Handel Set in particular are a model of what variations should be—extraordinarily fertile in device and rich in contrast, and at the same time persistently faithful to the melodic and harmonic contours of his theme. Bach on the other hand (in the "Goldbergs") and Schumann (in the *Etudes Symphoniques*) are sometimes carried away by their own imagination to the point of forgetting their hearers altogether. As music, the "Goldbergs" are one of the wonders of the world—but only an optimist can take them seriously as variations.

There is a special variety of the variation-form which calls for brief description—that known as variations (or "divisions") on a ground. The distinguishing feature of this is the persistence of a single phrase repeated over and over again in the bass, each repetition, or pair of repetitions, forming the basis of a new variation in the upper parts. These variations are self-subsistent—that is to say, they fit harmonically over the ground-theme, but are not in any sense derived from it. The ground is thus a highly formal type of structure, but very imposing if skilfully managed. The task is not easy, for the " joins " at the end of each repetition are apt to produce a too-strongly cadential kind of harmony, and thus the continuity of the fabric is easily impaired, unless the composer is very definitely on his guard.

Special types of ground are the *Chaconne* and the *Passacaglia*. Both terms are somewhat vaguely used. Both are strictly speaking in triple time, and the chief difference between them is that in the *Passacaglia* the ground is plain, whereas in the *Chaconne* it is harmonised. The finale of Brahms' E minor Symphony is an excellent example of the large-scale *Chaconne*, although it is not so labelled by the composer. This is said to have wrought great havoc amongst the critics when the Symphony was first produced ; the unhappy tribe settled themselves comfortably to hear something in ordinary sonata-form, or at worst a rondo ; they soon lost all their bearings, and were left floundering helplessly. After the *Eroica*, one would think, they might have been forewarned.

The Concerto

The Concerto probably owes its origin to purely practical considerations. In the early days of orchestral music, the standard of execution amongst the players varied a great deal ; the Concerto sought to turn this discrepancy to good account by contrasting " tutti " (*i.e.* full orchestra) passages with others in which a small and skilful band of players (the " Concertino ") could display their powers. It was not virtuosity in the modern sense that was demanded of the Concertino, so much as a high degree of neatness and precision, which in those days could not have been expected from the back benches. Incidentally, too, the change from *tutti* to *soli* produces a surprising contrast of tone-colour, even when the solo instruments are of the same kind as the *tutti*. To realise this, one has only to listen to Elgar's *Introduction and Allegro* for string orchestra and string quartet, or to Vaughan Williams's *Fantasia on a theme by Thomas Tallis*, in which again a quartet of solo strings is contrasted both with a partial and a full string *tutti*.

Therefore, one must not think of the Concerto as being at first a vehicle displaying the powers of a single individual, such as it afterwards became. Concertos for a single instrument there certainly were—*e.g.* the clavier and violin Concertos of Bach. But more frequently it was of what is known as the " Concerto Grosso " type, in which the *tutti* are contrasted with a small group, not with an individual. Occasionally it might even be written for such a group alone, without any contrasting *tutti* ; such a one is Bach's " Brandenburg " Concerto in G, written for three violins, three violas, three violoncellos, and double-bass.

The form adopted for these works was usually that of the Sonata ; but, as we have already seen, the Sonata of those times was very different from what it afterwards became ; it was a term of loose application, often approximating closely to what we should call a Suite. It is impossible, therefore, to lay down any rules of formal treatment ; think simply of a Suite or Sonata of the old-fashioned type in which certain passages are performed by soloists or a small picked group of players, alternating with others in which the whole body of players take part, and you have as clear an idea of the Early Concerto as it is possible to give without a detailed analysis of individual works.

The later Concerto (whose form was really settled by Mozart) is a different affair altogether. It is more definitely a *bravura* piece, it is written usually for a single performer, and it is cast in the strict form of the classical Symphony, except that there are only three movements, the minuet or scherzo being omitted. As regards the second and third movements, it is again difficult to define precisely how the form is modified to suit the medium ; there are passages for solo alone, and passages for *tutti* alone ; also passages in which the solo plays together with—at times one might even say, in opposition to—a partial or full *tutti*. Details of these different combinations and alternations vary in each individual work ; but the main outlines of the form—Rondo, Sonata, or whatever it may be—are not as a rule obscure or hard to follow.

In the opening movement, however, there is a set mode of procedure which is worth noting. The exposition is given first to the *tutti* alone. It is commonly abbreviated to some extent and confined as a rule to the tonic. Not till this preliminary exposition is over does the soloist enter ; the exposition is then repeated in full with the soloist participating, and this time, of course, the usual modulations and contrasts of key are introduced, precisely as in the exposition of a Symphony. After that, the development and recapitulation proceed as usual, the soloist participating more or less continuously.

This treatment of the exposition was faithfully observed by Mozart and his contemporaries, also to a very large extent by Beethoven and later by Brahms. After Beethoven's time, however, the convention was often disregarded ; one finds even so conservative a composer as Mendelssohn, for example, preferring in his violin Concerto to plunge directly *in medias res*, and entrust his opening theme to the soloist.

Some may think that the vocal as well as the instrumental forms should have been explained to some extent in this Article. The reason for omitting them is that where the form is entirely dependent on the words, it is too elastic and too variable to lend itself to general analysis. There are many vocal works, however, where the form as a whole is not thus dependent. I am thinking of the great mass of liturgical and semi-scriptural compositions in which short fragments of the text are taken and made individually the basis of the successive movements, each fragment being sung over and over again throughout the course of its own particular movement. In such movements the form is only conditioned by the words to this extent, that the theme itself is necessarily adapted to them. The movement as a whole will commonly be found on analysis to be constructed on precisely the same lines as an instrumental movement of the corresponding type—enlarged ternary, fugue, or whatever it may be. A study of such works as Bach's *B minor Mass*, Brahms' *German Requiem* or Dvořák's *Stabat Mater* will make this perfectly clear.

A word of caution before leaving this subject. Musical form in its completeness is a living thing, an organic and beautiful growth, which in the long run defies analysis. We can dissect the bony structure of the human body as much as we will, and yet never come within sight of solving the mystery of that " warm breathing beauty of flesh " which constitutes the human form divine. So in music ; mere analysis will never reveal to us how it is that the many themes of the *Eroica* unfold out of and into one another so miraculously that each as it appears is felt to be the completion and consummation of the one before it. That is Beethoven's secret ; we may possess it, but we may not understand it. None the less there *is* an anatomical structure of music on which its true form is moulded, just as the tissues of the living form are moulded on the bony framework underneath. What has been attempted here is an outline of this anatomical study. Such study, indispensable for the composer and the performer, is by no means so for a listener who is content to leave his brains on the doorstep when he goes into a concert hall. And many listeners are of this kind ; they do not concern themselves with any process of musical thought ; they surrender themselves passively, and resort to music chiefly as a means of inducing reverie. These may even be a majority, but there are countless others to whom music is or could be something more than this vague sensuous enjoyment. For them, it will be a help to have some slight acquaintance with musical physiology, such as these pages offer.

PART II

MODERN PROBLEMS

I

Musically, as in other respects, this is an age of transition. On the one hand, composers continue to write in the old forms, and to a large extent in the old idiom ; in Elgar and Sibelius, for example—who, to put it mildly, are not least among their peers—you will probably not find a single chord that could not equally be found in Mendelssohn or Tschaikowsky. At the other end of the scale there are the wild men of every shape, size and nationality, who have broken more or less completely with the harmonic idiom of music as we have hitherto known it. With them are associated the various experiments in quarter-tones, polytonality, atonality, etc., which till recently have almost monopolised the attention of musical critics, especially on the Continent. To read the effusions of some of these gentlemen, one would think that novelty of harmonic idiom was the sole musical desiderium. And in between these two classes—the conservatives and the wild men—come the less fanatical modernists of all countries, composers who are in no sense revolutionary, yet whose music does sound in some indefinable way different from the music of the classical age.

Let us defer consideration of the more radical experiments, and confine ourselves for the moment to the general modernist attitude. To be more precise, let us try and define briefly the attitude of modern composers towards the problems of harmony and design, for these are the two aspects from which the question may most conveniently be approached. Texture is equally important, of course, but the texture of modern music is so various and so complex that a discussion of it could hardly be kept within the scope of this outline, or rendered in terms which the layman could readily understand.

First, then, as regards design. The whole tendency of modern music has for some time been more and more towards abolishing the old formalities of structure. This is true alike on the largest scale and the smallest. Cadence in the old sense is almost a thing of the past; phrases, sentences, periods are no longer balanced in symmetrical antithesis, but have become as wayward and flexible as the sentences and periods of a prose discourse; music, in short, has freed itself, for better or worse, from the trammels of metre. Measure of course remains, for a conductor still has to beat time, or the players could not keep together. But the accents and stresses of the musical phrase are continually falling across the bar, so to speak; they no longer coincide with what were formerly known as "strong" beats, which now have scarcely any accentual significance. And precisely the same is true of musical form as a whole. One sees a modern work bearing the title "Symphony" or "Sonata," but till one opens it one has no idea how many movements there will be; how they will be constructed; or what will be the order of their succession. Themes are no longer presented in a continuous exposition before they are developed, so that one can no longer think of "exposition" and "development" as two distinct and clearly recognisable compartments; they have merged into a single continuum in which what is happening at any given moment after the first few bars may be expository, or transitional, or developous.[1] One can never know beforehand. And as for the recapitulation—well, there may be a reference to it in the analytical programme, but you are fortunate indeed if you are able to recognise it as such at a first hearing.

In a word, form is no longer generic, but individual; it is more and more conditioned by the content of a work, and can seldom be analysed except with reference to that content. This may be, ideally speaking, the highest condition to which form can aspire; but such an ideal makes very exacting demands upon listener and composer alike. Only the greatest—the Beethoven of the last quartets, the Sibelius of the 4th and 5th Symphonies, the Wagner of the *Tristan* prelude—can fully achieve it. And, lacking this perfect consummation, music so constructed easily degenerates into inconsequence and improvisation. For composers of less than the highest stature, more formal methods of design are still appropriate, and those who are wise enough to know their own limitations will not disdain them. For this reason, I think, the swing of the pendulum is sure to come in course of time, even though formality seems at the moment to be out of fashion.

2

Harmony

Another factor that perplexes and disconcerts many a listener when he first approaches modern music is its high degree of dissonance. Here, once more, his instinct is probably right in the main. Consonance and dissonance have already been defined in terms of sound (v.s., p. 1010), but if sound was merely sound, music would not be worth troubling about. The acoustical distinction between consonance and dissonance has its counterpart in psychology; whether by chance association or some inherent property, dissonance in music has always signified the element of tension, consonance that of relaxation. And just as the human soul passes the whole of its conscious existence in a state of more or less continuous reaction or oscillation between these two extremes, so in the past the very being of music has always depended on the free interplay of consonant and dissonant elements, each of which acquired significance only by virtue of its contrast with the other.

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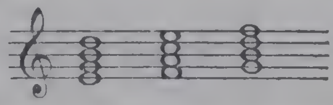
[1] I apologise for this adjective, but as it did not previously exist it was necessary to invent it.

Therefore, when one is asked to listen—as one often is to-day—to an all-dissonant music, one is in effect being asked to endure a state of continuous tension. Why should one? I for one believe that the instinctive hostility evoked by a great deal of contemporary music is due to this unwarrantable demand it makes on the listener, and to that extent well justified. It does not follow, however, that we can permit ourselves a purely static conception of discord, or assume that the nineteenth-century view of it is entirely adequate for ourselves. Ignore all merely provocative experiments; there still remains a great mass of modern and near-modern music, written within the last fifty years, which contrives to sound perfectly euphonious, and yet certainly treats discord with a freedom quite foreign to the old classical and romantic traditions. If that tradition was right in its view of discord, this newer music ought to sound all wrong. Yet it does not sound all wrong. Why? This is a question which theory hitherto has never squarely faced.

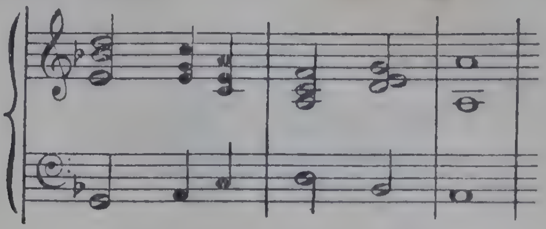
The answer, it seems to me, lies in the very definition of discord—a chord containing one or more dissonant intervals. One single dissonant interval, that is to say, is enough to turn what would otherwise be a concord into a discord. But this view of discord simply does not square with our common experience. Take the diatonic seventh in its three commonest forms:—

Ex. 60.



In each of these the seventh is the only dissonant interval; in the middle one the seventh is major, and therefore rather more acutely dissonant than the other two. For the rest, each chord contains five other intervals —three thirds, major and minor, and two perfect fifths—all of which are consonant. Invert them and space them as you will, this remains true, for the thirds invert into sixths, the fifths into fourths, which again are respectively imperfect and perfect consonances. So that each dissonance is tempered and mitigated by the vicinity of five consonances, two of which are actually perfect. This proportion, moreover, is increased when one or more notes of the chord are doubled at the unison or octave, for the note so doubled is normally not the dissonant note. Small wonder, then, that Vaughan Williams can open *Towards the Unknown Region* thus without fear of cacophony :—

Ex. 61.

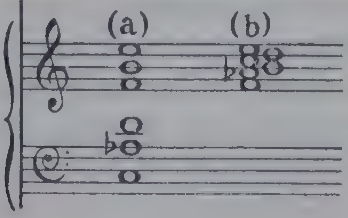


for the fact is that we simply do not hear these chords as discordant ; the preponderance of the consonant intervals overpowers the single dissonance. It has taken the human ear several centuries to adjust itself to this view, but the adjustment has been made. There is no longer room for doubt here ; such treatment of the seventh is a commonplace of modern music, and causes no discomfort even to the most sedate of listeners. It is therefore merely silly of theory not to recognise it, and offer some kind of explanation.

Of course this makes it much harder to formulate any set rules of modern harmonic procedure ; in fact, it makes it impossible. As long as a single dissonance was enough to constitute a discord, one could pounce on it and virtuously demand its resolution, no matter how the rest of the chord was made up. Now this is impossible, for one can no longer say precisely what a discord is ; a conception previously rigid and absolute has become fluid and relative, and dogma must henceforth give way to individual judgment and perception. Or, to put it another way, the ingredients of modern harmony are not now mathematical, but rather chemical. The most unpromising collocation of notes may turn into a chord, whose precise effect in a particular context probably cannot be forejudged ; it may have to be tried experimentally at the piano, whose rôle in the extension and development of harmonic resource has been of incalculable importance. Formerly a composer who used the piano in this way was supposed for some obscure reason not to be quite playing the game. This form of snobbery is now a thing of the past ; a modern composer's obligation to his piano is no longer matter for pride or shame, but is simply taken for granted.

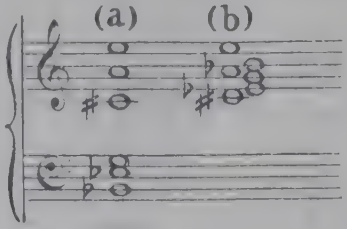
There is another element in modern chord-formation that has come to be recognised as of vital importance—that of the spacing and arrangement of the notes. Turn back to p. 1015, and you will recall that any of the simple fundamental chords that formed the basis of eighteenth and nineteenth century harmony could be spaced in a score of ways without infringing the limits of euphony or changing the essential nature of the chord. With the more complex modern chords one has to be much more careful. Consider the following :—

Ex. 62.



The notes are the same in both, yet (*b*) is beyond all question harsh, messy, and cacophonous, while (*a*) would hardly pass for a discord at all. This is particularly true of " polytonal " chords, *i.e.* chords formed from more than one tonality :—

Ex. 63.



At (*a*) the combination of A major and E♭ major is positively mellifluous ; the rearrangement at (*b*) is harsh and confused. So that instead of saying, as we used to say, " a chord may be spaced in any number of ways," we must now rather say " the spacing is the chord."

3

Polytonality

The last example leads us naturally on to the question of polytonality in its more general sense. This means literally, as was said, the combination of many keys or tonalities. There is nothing in the formation of the word to imply that these several tonalities must necessarily occur simultaneously. A " polytonal " piece of music might thus mean merely a piece which passes rapidly from one key to another and does not end in the key in which it began. In this sense a great deal of modern music contrives to be polytonal without occasioning anyone much discomfort. Listeners with an absolute sense of pitch are in a very small minority ; the others quickly lose their sense of the opening key in a work of any length or complexity. Unity of key was in theory the corner-stone of symphonic construction up to the close of last century, but probably the average concert-goer would freely admit that thematic development and continuity of thought are what really give unity to a musical composition, so far as he is concerned. It might even be claimed that unity of key is very often a factitious unity at best, and that the inner emotional logic of a piece may actually need a different key in which to conclude. At any rate, it is an open question, which every composer may fairly claim to decide for himself.

As used to-day, however, the term does mean, as a rule, " the employment of two or more keys *simultaneously*." Such procedure is from the very start open to grave suspicion on æsthetic and psychological grounds. Key is essentially a means of creating and preserving unity ; if it were not for this need of unity, there is not the slightest reason why even the simplest folk-song or hymn-tune should finish in the same key in which it started. Therefore, polytonality is in effect the attempt to establish two or more conflicting unities at the same time. As such it seems foredoomed to failure, except perhaps as an occasional device ; and even so it seems more appropriate to works for the stage, where it might be justified by some point in the dramatic situation, than to absolute music.

None the less it is worth while to glance at the technical problem it raises, because this, as it happens, can be stated in simple terms. Let us assume for the moment that not more than two keys are in question, for the difficulties thus arising are not in any way altered but merely intensified, if the number is increased. The simplest form of composition to which such a method could consistently be applied would be a two part invention, constructed of two melodic parts, each of which was written in a different key. Here, the conflict of unities would of course exist, but the two parts need not necessarily come into very violent harmonic collision at any given point. The effect is one of confusion rather than of actual cacophony. In a more complex composition it would be otherwise; each part would have to be accompanied by harmonies appropriate to its own particular key. These harmonies might be expressed as plain chords, or as harmonic figuration, or by some more contrapuntal type of texture, but each of these alternatives would necessarily give rise to a stream of more or less acute dissonance, of which the ear would quickly grow tired. I am speaking in hypothetical language, but experiments in polytonal combination have been freely made by Stravinsky, Milhaud, Hindemith, and others, so that everyone who is willing to take a little trouble can judge for himself, if he feels so inclined. He must however try and discount the interest that pure novelty of sensation is almost certain to arouse, for that quickly passes. The real question is whether polytonality provides a method of permanent value and universal appeal. Personally, after being strongly attracted by it for a time, I have come to the conclusion that it does not, and for the reasons which I have tried to analyse above. Many of equal or greater authority would not agree ; time alone can show which view is right.

4

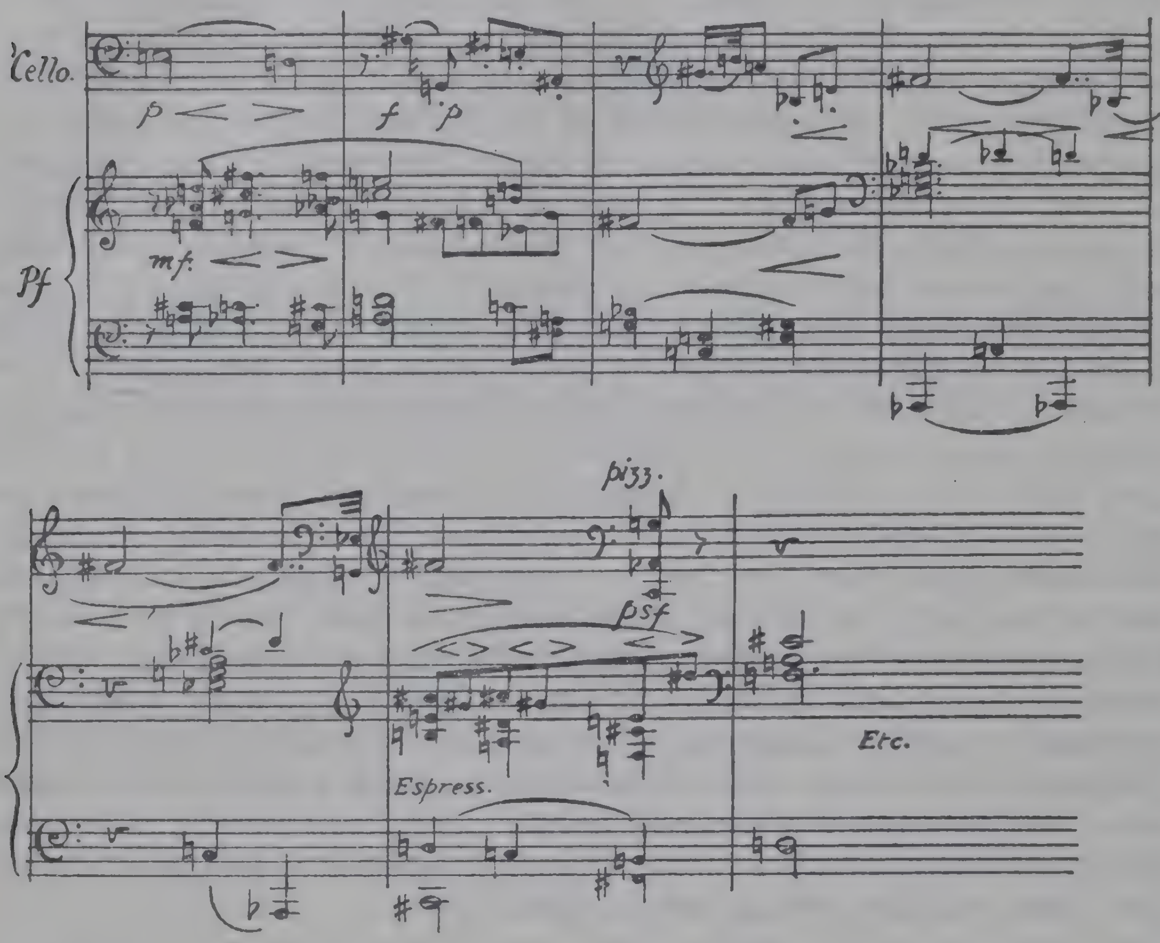
Atonality

" Atonality," like " polytonality," has in current usage a more limited and precise meaning than the actual formation of the word might suggest. It does not mean merely that in a given piece there is no definitely principal key, or that important sections of it may be tonally ambiguous. It starts with a definite theory of scale-formation, and deduces therefrom a complete method of musical composition, which is pursued relentlessly to its logical conclusion. The theory may be outlined thus :—

The scale consists of twelve semitones, all of which are, in the widest sense of the word, of equal value. Pre-existing relationships within the scale are abolished out of hand; there is no tonic, no dominant, no anything of the kind; one note is as good as another, and any note may occur in juxtaposition with any other note at any point of the musical phrase. Harmony results from the combination of the notes of the scale, therefore harmony too must reproduce this state of equality and fraternity ; one note is as good as another, therefore one interval is also as good as another ; so also the chords into which these intervals are combined.

This theory, or method, or whatever you like to call it, is associated entirely with the name of Arnold Schönberg and a handful of his disciples—Alban Berg, Anton von Webern, and one or two others. Lest it be thought the above description is exaggerated, let me hasten to subjoin a few bars from Schönberg by way of illustration :—

Ex. 64.



These bars are taken from No. 19 of *Pierrot Lunaire* ; it may interest the reader to learn that the number is entitled " Serenade." What I wish first of all to emphasise is that they are an absolutely normal and representative specimen of the Schönbergian procedure ; they were indeed chosen almost at random from the first work of his I happened to pick up. The early Schönberg is associated with such verbose and heavily romantic compositions as *Verklärte Nacht* and *Pelleas* ; about op. 12 or possibly earlier we begin to notice a transitional style, which is quickly outgrown. From op. 18 (or thereabouts) he has written consistently in the idiom here shown ; *Pierrot Lunaire* is actually numbered op. 21.

Once more, I must confess to my total inability to foresee any possible future for this kind of thing. This complete upsetting of all traditional values, this disdain of all previously accepted melodic and harmonic relationships, suggests to me, not so much courage and sincerity, as an inflated arrogance of mind that can only be described as megalomania. To my ear it makes no more sense to-day than it did when I first made its acquaintance some fifteen years ago. Schönberg's experiments have aroused so much discussion in the past few years that it was impossible to omit all reference to them here. But one can only speak for oneself, and to me the result is pure anarchy and destruction of musical values—a dreary wilderness of cacophony that somehow contrives to be pedantic and hysterical at the same time.

Before leaving this topic, we may perhaps do well to remind ourselves of the enormous part played by tradition, inheritance, and association in the building up of our common musical language. The chords, progressions, and cadences of which that language has hitherto largely consisted, are not the invention of any individual ; no one composer has contributed more than a minute fraction of that common store of material, nor—till to-day—has he ever sought to do so. The greatest composers have usually been consolidators rather than innovators ; they have taken the language and idiom of music as they found it, and concerned themselves little with harmonic discoveries or new turns of speech. That language has grown, insensibly and continuously, by a process of slow accumulation and extension throughout the centuries ; it has had time to build itself into the very foundations of our consciousness, and so to become the vehicle of a musical speech that is felt not merely as sound but as sense. A Bach fugue or a Beethoven symphony is not merely reasoned in its general construction, it is logical in its progress from bar to bar. And as it has been in the past, so must it be in the future. The new must somehow incorporate the old, it must be felt as one with it, if music is to be anything more than a series of novel sensations. A composer who wants to reach the hearts and minds of his audience simply cannot afford to spend his time inventing a new language ; nor, if he did, would his audience trouble to learn it. Why should they ? They have their Bach and their Handel, their Haydn and their Beethoven, and all the other masters, great and small, who are of their lineage. The new can enrich the old, it may not supersede it.

Yet this, and no other, is what composers have largely been attempting to do since the time of the War. They have sought to create an entirely new instrument of musical speech, shunning familiar cadences and progressions as if they were the devil itself. Probably all the harmonic experiment of recent years will show, in the long run, very little that can be incorporated and assimilated by the language of the classical tradition—far less, at any rate, than is now hoped and claimed. That language, however, is the stem from which the music of the future will grow, even as the music of the past. Only that which can be grafted on to that stem is worth keeping.

PART III

EARLIER DEVELOPMENTS

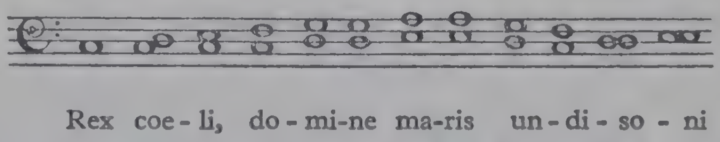
I

The period that has to be summarised in these concluding pages is one of no less than 750 years, *i.e.* from *circa* 850 (the first appearance of anything that could be considered as harmony) till 1600, which brings the first epoch of musical maturity to a glorious close. The last 50 years of this period far outweigh the earlier 700 in musical value ; therefore, in order to reserve as much space as possible for their discussion, the earlier years will only be outlined in a brief tabular chronology. Those who wish to amplify this outline must have recourse to the histories, but let them be forewarned that throughout this early period the interest is antiquarian rather than musical. Its appeal is to the specialist, and a general sense of its chronology is really all that the ordinary music-lover need carry in his head.

This outline, then is as follows ; dates of course must be taken as approximate :—

(1) 850–1050. Voices move in similar or oblique motion only, except at the cadence. Intervals used are those of the unison, octave, fourth, and fifth only, except when the motion is oblique ; other intervals may then occur, but all such intervals are regarded as dissonant. No measured rhythm ; the accompanying voices follow the spoken rhythm of the intoning voice as best they can. This method is known as that of the OLD ORGANUM ; here is a specimen from Wooldridge :—

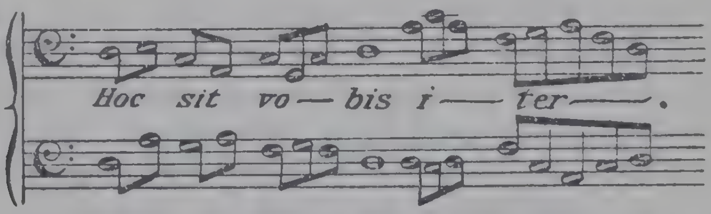
Ex. 65.



(2) 1050–1150. Similar to the above in rhythm, but contrary movement is freely employed, and parts are allowed to cross. Basic harmony is still that of the unison, octave, fourth, and fifth; but the contrary movement necessitates a more extended (though still quite experimental) use of the other intervals.

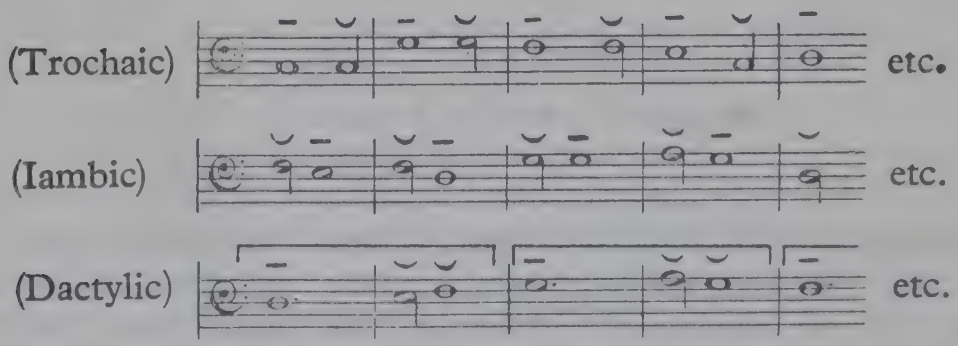
This is known as the NEW ORGANUM ; here again follows a specimen from Wooldridge :—

Ex. 66.



(3) 1150–1300. Musical measure is invented by borrowing some of the commonest poetic metres—iambus, trochee, etc.—and adapting them to musical requirements, long and short syllables being represented by longer and shorter note-values.[1] For example :—

Ex. 67.



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[1] It should be noted that the metrical framework is always one of triple time Duple time only appeared in the fourteenth century. Therefore the ∪ ∪ of the dactyl is represented by the same relative note values (𝅗𝅥 𝅝) that have to do duty for the ∪ – of the Iambus - a third degree method of torturing these unfortunate notes.

Harmonically no great change ; octave, fourth, and fifth still prevail, but thirds and (later) sixths begin to be recognised as partial consonances. This period is known as that of DISCANT.

This concludes what we may call the palæolithic period of European music. Another 250 years, more or less, have to elapse before the first period of its full maturity is reached ; but throughout those years progress is continuous. One can no longer say, " At such and such a point this or that was invented" ; one must view the period as a single stretch of musical history during which technique and style were steadily developed and refined into an instrument of singular perfection—more perfect, indeed, through its very limitations, than that of any later age.

There is an immense bulk of contemporary literature dealing with the theory of music at this time. It is written for the most part in dog-latin, and as it is often highly obscure and controversial we shall not here review it. It is always more satisfactory to establish your theory inductively by inference from actual practice, and the reader may take it that what here follows has been so established, though of course conclusions alone can be stated. It would take a large volume to collate and compare all the examples from which those conclusions are drawn.

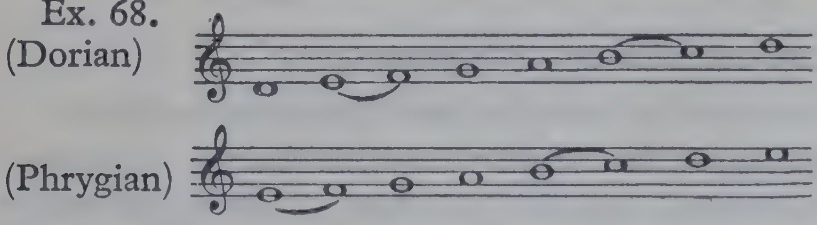
2

Scale : The Modal System

Our own major and minor scales are survivals of six older scales (or " modes " as they were then called) which survived down till the very end of the sixteenth century. Morley (writing in 1597) speaks of the modal system as something archaic and fallen into disuse, but it is incontestable that Palestrina (who died in 1594) was in all matters of modal procedure as orthodox at the end of his career as he had been at the beginning. The fact is that the transition from mode to scale was so gradual that no one can say exactly when it took place.

To return. All these modes were strictly diatonic ; that is to say, they all consisted of five tones and two semitones ; but the order in which these occurred was different in each mode. The easiest way to understand them is to think of the white keys of the pianoforte, and imagine a succession of scales, each formed of that series, but each starting and finishing on a different note ; *e.g.* :—

Ex. 68.

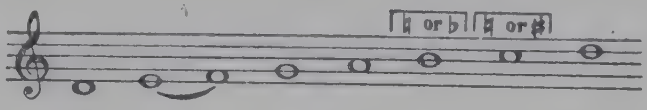


And so on ; the names of the other modes, starting respectively on F, G, A, and C, are Lydian, Mixolydian, Æolian, and Ionian. These names (borrowed from the old Greek scales) do not really matter very much, and are only put in here for the sake of completeness. There is no mode starting on B because the false fifth (B♮ – F) made that series unusable.

The reader will probably ask at this point, Were chromatic notes ever used ? To which the answer is that they were, and that from the very first moment of their introduction the modal system as such was potentially doomed, although centuries were to elapse before the downfall was complete. They were not introduced all at once, but B♭, F♯ and C♯ were in frequent use before the end of the fourteenth century, and were followed before long by E♭ and G♯, while such remote accidentals as A♭, D♭, D♯ are by no means unknown in the madrigals of the later sixteenth century. They were used chiefly for two purposes—to correct the tritone (*i.e.* the false fifth B – F, or its inversion) and to raise the seventh note of the scale so as to form a perfect cadence when required. They were not always indicated by the composer,[1] but automatically inserted during a performance for the two purposes above mentioned, as also for certain others, which need not here be specified.

Consider now the effect of all this. Take the Dorian Scale shown above ; imagine that every time a B comes near an F it is changed into B♭ ; every time a C leads cadentially up to D it is changed into C♯. In effect, the scale is now as follows :—

Ex. 69.



And what is this but our old friend the " melodic " minor scale ? Apply this, *mutatis mutandis*, to the other modes, and you will understand how it was inevitable for the modal system to give way sooner or later to the two-scale system of our own times. There was no conflict between them, merely a gradual and imperceptible transformation of the one into the other.

3

Harmony

The harmonic basis of this early polyphony is very simple. To understand it, one need only focus the attention on two questions, which are both capable of straightforward answers. The questions may be posed as follows :—

(1) What was the general view of dissonance ?

(2) How did they set about combining intervals into chords ?

As regards dissonance, the practice was far stricter than that of the eighteenth and nineteenth centuries. In those centuries, as we saw, dissonance could be freely approached so long as it was duly resolved. In the earlier period, dissonance has to be *prepared* as well as resolved ; that is to say, the dissonant note must form part of the essential harmony of the previous chord, as, for example :—

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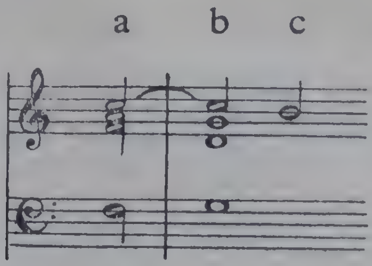
[1] Hence the name " Musica Ficta " by which this procedure of chromatic alteration was generally known.

Ex. 70.



The technical description of this procedure is that at (*b*) the note C is a suspended dissonance, prepared at (*a*) and resolved at (*c*). This attitude towards dissonance—as something needing preparation as well as resolution—persisted to the very close of the sixteenth century. It is easy to produce exceptions from the madrigalists, who were more experimentally minded than Palestrina, Victoria, and the other great church composers of the time. But even in the secular work taken as a whole, infringement of the rule is of negligible frequency compared with its observance. We may therefore summarise the history of dissonance (ignoring the palæolithic period) as follows (it will be understood that there is always a certain overlapping between the end of one period and the beginning of the next) :—

Till 1600, dissonance requires both preparation and resolution.

From then till 1900, it need not be prepared, but it must still be resolved.

Since 1900 it has not necessarily required either preparation or resolution.

And as all progress has to be paid for, it may be confessed that each successive gain of freedom and expressive power has been compensated by a definite loss in purity of sound, and also in clearness and precision of style. In these latter qualities the music of the sixteenth century is the most perfect that has ever been in this world, or probably ever will be.

Turning now to the question of chord formation, one may sum up the whole procedure as follows : any number of mutually consonant intervals may be sounded together in the form of a chord. One should at once add that the fourth from the bass, even in its perfect form, is no longer considered a consonance. Between any two upper parts, yes ; between any upper part and the bass, no. It has never been quite clear why the fourth should have suffered this change of status ; it certainly will not combine with the third, whereas the fifth will, but that does not really explain how it came to be regarded as *per se* dissonant, nor why this supposed dissonance should be ignored, so long as the interval is confined to the upper voices. The whole business is thoroughly irrational and inconsistent ; nevertheless it happened.

The grouping and classification of these fundamental concords came later. In saying (as we commonly do say) that the common chord and its first inversion formed the basis of Palestrina's harmony, we are guilty of an anachronism, for he would not have understood the description or admitted the relationship. To him the chords $\begin{smallmatrix}\text{C}\\ \text{A}\\ \text{F}\end{smallmatrix}$ and $\begin{smallmatrix}\text{F}\\ \text{C}\\ \text{A}\end{smallmatrix}$ would have been essentially different chords, because they are compounded of different intervals. So with the discords; although by the device of "suspension" they were all brought into frequent use, they were not, so to speak, officially recognised. This too came later. The point is, that the seventeenth century composers found all the harmonic material they wanted ready to hand. They had to name it and classify it, and to free themselves from certain restrictions in the manner of employing it, but they did not have to discover it; that had already been done for them. It is therefore misleading to speak of 1600 as a time of harmonic revolution, for it lays a wrong emphasis. The really revolutionary changes were those of rhythm, texture, and design. Compared with these, the actual harmonic changes during the next hundred years or so were insignificant.

4

Rhythm

Early in the fourteenth century the rigid pseudometrical patterns described above were discarded in favour of a sensible and straightforward system that still serves us to-day. The names are different, but the thing is the same. What we call triple or duple time, they called respectively Perfect or Imperfect time; our further sub-divisions of time into simple and compound were known as the Lesser and Greater Prolations. The note values were the same relatively but not absolutely, for the semibreve, which is to-day the largest note value in general use, was at first the smallest. Above it were the breve and the long. Soon the long dropped out and the breve took its place, with the semibreve and minim ranking below it; the smaller notes—crochets, quavers, etc.—followed in due course. Generally speaking, we may take breve, semibreve and minim of those days as the respective equivalents of our semibreve, minim, and crotchet, or possibly (in quicker tempo) of our minim, crotchet, and quaver. The following table will make this plain at a glance:—

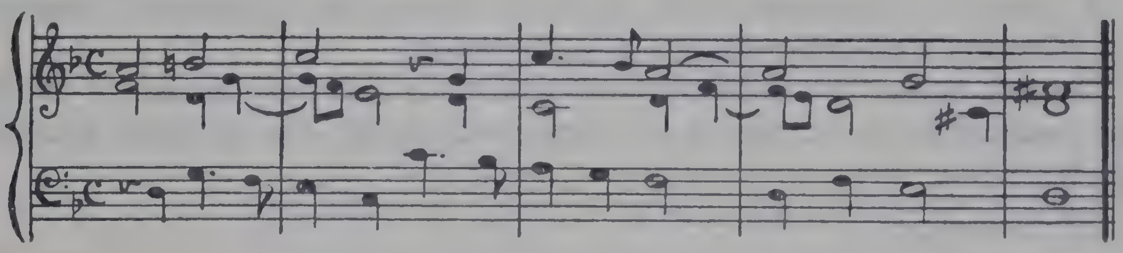
	Name	Sign	Our Equivalent
1.	Perfect Time Greater Prolation	⊙ or ⌽	$\genfrac{}{}{0pt}{}{9}{4}$ or $\genfrac{}{}{0pt}{}{9}{8}$
2.	Perfect Time Lesser Prolation	O or ⌽	$\genfrac{}{}{0pt}{}{3}{2}$ or $\genfrac{}{}{0pt}{}{3}{4}$
3.	Imperfect Time Greater Prolation	Ͼ or ₵	$\genfrac{}{}{0pt}{}{6}{4}$ or $\genfrac{}{}{0pt}{}{6}{8}$
4.	Imperfect Time Lesser Prolation	C or ₵	₵ or $\genfrac{}{}{0pt}{}{2}{4}$

The circle represents perfection (triple time), the semi-circle imperfection (duple time). The dot means " compound " time ; where there is no dot, the time is " simple." The vertical line through the signature means that all note-values have been halved—*i.e.* that the semibreve, instead of the breve, is the unit of measurement.

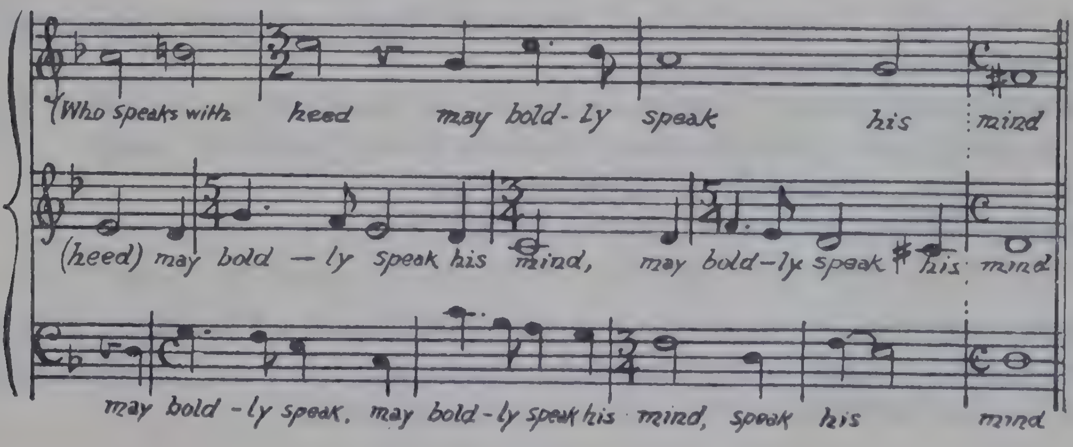
Of course we have in current use many other time-signatures not included in the right-hand column of this table. But though the old system was thus apparently less extensive than our own, it was adequate for all practical purposes, containing as it did the essential divisions of duple and triple, simple and compound. If we chose to adopt the crotchet as the uniform beat, we could ourselves eliminate a good many superfluous time-signatures without really diminishing our metrical resources at all ; $\frac{9}{8}$ time, for example, is to the ear precisely the same as $\frac{9}{16}$, so why have both ?

Rhythm, however, is more than metre, and so far we have only been considering it as a system of time-measurement and its notation. This was merely a framework, within which the individual voices acquired an extraordinary degree of suppleness, freedom, and independence of accent. In the madrigal, more especially, the composer sought above all to reproduce in his musical accentuations the natural stress and thrust of the syllables. The harmony is measured, in that dissonance may only occur as a rule on the " strong " beat ; if it occurs (as an occasional licence) on a " weak " beat, it must resolve with all speed before the next beat is reached. But the voices are not measured in this way at all ; their accents—indicated more by duration than by stress—pursue a wayward and mutually independent course, in which the natural syllabic accentuation is faithfully reproduced. A single example, chosen from Byrd's *Who looks may leap*, will make this clear. It is shown below in two ways ; first in short score, with regular bar-lines inserted to mark off the time-divisions in accordance with the signature C ; second, in open score, with irregular barring to show the accentuation of each individual voice :—

Ex. 70A.



Ex. 70B


Who speaks with heed may bold-ly speak his mind
(heed) may bold — ly speak his mind, may bold—ly speak his mind
may bold-ly speak, may bold-ly speak his mind, speak his mind

The difference is astonishing to the eye, and not less so to the ear, once it has learned to listen in the right way. It is no use hearing a madrigal *vertically*, one must learn to hear it *horizontally*, *i.e.* as counterpoint, a simultaneous confluence of independent melodies and rhythms. Only so can one begin to appreciate the beauty of this wonderful music, so intricate and subtle in texture, and yet so direct in utterance. Its very perfection was its undoing, depending as it did on the peculiar limitations of its medium. For it is essentially music for the human voice, it needs the interplay of actual words and syllables to give it substance. And by 1600 the dominion of the voice was over; instrumental music, demanding quite other types of rhythm, texture, and design, was entering into its kingdom. The change had to come, and the gain on balance was immeasurable; but those who have once fallen under the spell of this older, quieter music may be forgiven an occasional sigh when they recall its brief and lovely heyday.

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